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Draft Report

BBTCA Noise Impact Assessment

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SUBMITTED TO

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1. INTRODUCTION

RWDI AIR Inc. (RWDI) was retained by Dillon Consulting Limited (DCL) on behalf of the Toronto Port Authority (TPA) to conduct a noise impact assessment in the area of the Billy Bishop Toronto City Airport (BBTCA). RWDI conducted a similar noise study in 2005 related to the Ferry Passenger Transfer Facilities.[1] In order to assess future noise impacts in the area of the BBTCA, we have assumed that 202 aircraft slots/day would be used, with passenger volumes of 1.43 million/year in 2010 and 2.56 million/year by 2016. The assessment is intended to provide information about noise impacts related to aircraft movements; ferry service and road traffic in this area for 2010 and 2016.

1.1 Study Area

The study area includes the area north of the Western Channel, south of the Gardiner Expressway, west of Spadina Avenue and east of the Exhibition Park lands (see Figure 1). 2010 and 2016 residential developments in the area have been considered, as well as park spaces, schools, and other sensitive land uses. A land use zoning map for the study area is shown in Figure 2 and the zoning information is provided in Appendix A.

Representative noise sensitive receptors were identified in the previous studies. Modelled receptor locations are identified in Figure 3, and are described in Table 1 below.

Table 1: Modelled Receptor Locations

Receptor No.	Description
R1	School at Queen's Quay / Bathurst Street
R2	Bishop Tutu Residences
R3	Little Norway Park
R4	Norway Crescent Residences
R5	Queen's Quay / Stadium Road Residences
R6	500 Queen's Quay / King's Landing Residences
R7	Northeast corner of South Beach Marina Town Residences
R8	Southwest corner of South Beach Marina Town Residences

[1] Potential noise impacts from the operation of a proposed pedestrian tunnel were not included in this assessment as they were considered to be insignificant in the context of the overall noise environment.

2. ENVIRONMENTAL NOISE GUIDELINES

2.1 Noise Descriptors

A glossary of commonly used noise descriptors can be found in Appendix B. The basic descriptor used in noise impact assessment is the energy-equivalent sound level (L_{eq} value), which is an energy-averaged sound level taken over a specified period of time. It represents the average sound pressure encountered for the period. The time period is often added as a suffix to the label (i.e., L_{eq} (24) for the 24-hour equivalent sound level). An L_{eq} value expressed in dBA is a good, single value descriptor of the annoyance of noise. In Ontario, several averaging periods are used including:

- L_{eq} (24) – average levels over the whole 24 hour day;
- L_{eq} (Day) – average levels over the daytime period (0700h-2300h); and
- L_{eq} (Night) – average levels over the night-time period (2300h-0700h).

Airside noise impacts (i.e., noise from aircraft while in the air: flight, takeoff, or landing) are assessed in Ontario in terms of Noise Exposure Forecast (NEF) values. This measure of aircraft noise is based on a 24-hour energy averaged sound exposure, adjusted for tonality and penalties applied to nighttime over-flights (between 2200h and 0700h).

2.2 Noise Guidelines Used in This Assessment

Relevant noise guidelines for various activities related to the project are outlined below.

2.2.1 Road and Light Rail Traffic Noise Impacts

The Ontario Ministry of the Environment (MOE) and Canada Mortgage and Housing Corporation (CMHC) have guidelines which relate to road and light rail (LRT) traffic noise sources [1, 2]. These guidelines set out objectives for outdoor sound levels, as summarized in Table 2.

Table 2: Objectives for Road and Rail Traffic Noise Levels

Objective Level (dBA)	Time Period and Requirements	Reference Number
≤ 50	Night-time (2300h-0700h). Maximum facade noise level in plane of bedroom window, assuming 10 to 15 dB reduction through open window, to ensure that an adequate indoor noise environment is maintained. • Levels of 50 to ≤ 60 dBA require warning clauses registered on Title, and provision for installation of central air conditioning. • Levels > 60 dBA require warning clauses and central air conditioning, and require provisions for adequate sound insulation in housing construction (selection of appropriate wall and window types).	1
≤ 55	Daytime (0700h-2300h). Maximum facade noise level in plane of living room window, assuming 10 to 15 dB reduction through open window, to ensure that an adequate indoor noise environment is maintained. • Levels of 55 to ≤ 65 dBA require warning clauses and provision for installation of air conditioning. • Levels > 65 dBA require warning clauses and central air conditioning, and require provisions for adequate sound insulation in housing construction (selection of appropriate wall and window types).	1
≤ 55	24 hours. Maximum facade level where normal building construction is adequate to provide an acceptable indoor noise environment. • Levels of 55 to ≤ 75 dBA, requires adequate sound insulation in housing construction. • Levels > 75 dBA, area is unsuitable for housing.	2

2.2.2 Airside Noise Impacts

There are several provincial and federal guidelines which address aircraft noise, and attempt to ensure that airports and sensitive land uses be appropriately designed, buffered, and separated from one another to prevent adverse effects [3, 4, 5, 6]. These guidelines examine noise impacts for land use approvals and new residential development, over a range of NEF values, and provide specific guidance and requirements, which are summarized in Table 3.

Table 3: Summary of Airside Noise Guidelines Related to Residential Development

NEF Value	Requirements	Reference Number
$\leq$ 25	No requirements. Generally little or no annoyance with aircraft noise. Normal building construction should be adequate to provide an acceptable indoor noise environment.	1,3,4
25 to $\leq$ 28	Provisions for adequate sound insulation in housing construction are recommended. Residential development, schools, passive use parks and picnic areas are appropriate. Warning clauses are required to be registered on Title for new development.	1,3,5
28 to $\leq$ 30	Warning clauses are required to be registered on Title for new development, as well as provisions for air conditioning and proper sound isolation. Athletic fields, playgrounds, office and commercial uses are appropriate.	1,5
> 30	No new residential development.	6

The Tripartite Agreement

The operation of BBTCA is governed by the "Tripartite Agreement" signed by the City of Toronto, the Toronto Harbour Commission (now Toronto Port Authority), and Transport Canada [7]. Under the agreement BBTCA aircraft noise impacts, as measured by the NEF system, are limited to specific NEF contours provided by Transport Canada. Specifically, NEF 28 contours for future years cannot extend past the 1990 NEF 25 contours except in areas to the southwest over Lake Ontario. Night-time movements (past 2200h) are generally forbidden, with the exception of emergency air ambulance traffic.

Conversions Between NEF and L_{eq} Values

For comparative purposes, and to allow for assessment of cumulative noise impacts, NEF values can be converted to approximate L_{eq} values as outlined below [8]:

a) L_{eq} (24) = NEF + 37 (dBA); and
b) L_{eq} (Day) = NEF + 39 (dBA).

2.2.3 Groundside Noise Impacts

There are currently no guidelines in Ontario that are specific to the regulation of ground-based noise from airports or which address the potential impact of aircraft on existing residential developments. In the absence of guidelines that specifically apply, ground-based noise (i.e., noise impacts from aircraft activity while on the ground, including taxiing and run-ups and ground support equipment) has traditionally been addressed under MOE transportation noise guidelines previously discussed in Section 2.2.1.

The MOE has "stationary source" noise guidelines, which address noise impacts from sources confined to fixed site boundaries, such as an industrial plant [1, 9]. Transportation noise sources, while travelling within the boundaries of the site, are considered to be part of the stationary source for purposes of an assessment. BBTCA groundside noise could be considered as a "stationary source" under MOE guidelines, since the activities are related to the airport and occur within a fixed site boundary. MOE stationary noise guidelines are outlined in Table 4.

Table 4: Summary of Groundside Noise Guidelines

Guideline Limit (L_{eq} (1)) (dBA)	Time Period and Requirements	Reference Number
45	Night-time (2300-0700h). Levels from the “stationary source” should not exceed 45 dB or the background ambient noise level due to road traffic, whichever is higher. For example, if the lowest ambient L_{eq} (1) is 53 dBA, then 53 dBA becomes the limit.	1,9
47	Evening (1900-2300h). Levels from the “stationary source” should not exceed 47 dB or the background ambient noise level due to road traffic, whichever is higher.	9
50	Daytime (0700-1900h). Levels from the “stationary source” should not exceed 50 dB or the background ambient noise level due to road traffic, whichever is higher.	1,9

2.2.4 Ferry Noise Impacts

Similar to the groundside noise, there are currently no guidelines in Ontario that are specific to the regulation of ferry-based noise. For purposes of the assessment, the ferry noise will be assessed as a stationary source, since the operations will be confined to a fixed area within the site boundary. The MOE noise guidelines are summarized in Table 4, Section 2.2.3.

2.2.5 Cumulative Effects and Changes from 2010 Conditions

There are no guidelines that specifically address the potential noise impacts from the combined noise sources (road and LRT, airside, groundside, and ferry activities) with respect to the overall sound environment. In the absence of specific requirements, changes in sound exposures between 2010 and 2016 can be used to assess the potential noise impact. Based on general practice, changes in sound levels can be ranked as indicated in Table 5 [10, 11]

Table 5: Ranking of Changes in Noise Levels [10, 11]

Change (Increase) in Sound Level (dBA)	Human Perception of Change in Sound Level	Significance of Noise Impact
0 to 3	Imperceptible increase	Insignificant
3 to 5	Just noticeable increase	Moderate
6 to 9	Clearly noticeable increase	Significant
> 10	Perceived as a doubling in sound level	Very Significant

The change assessment ranking scheme above can also be applied to rank the impact of changes due to the proposed the total change in sound levels, as well as for each of the sub-categories (i.e., road and LRT, airside, groundside, and ferry noise).

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3. NOISE IMPACT ASSESSMENT - METHODOLOGY

Road and LRT sound levels were predicted using STAMSON v5.03, the computerized road and rail traffic noise model produced by the MOE [12]. The following factors were taken into account in this analysis:

- Horizontal and vertical road, and streetcar-receiver geometry;
- Ground absorption;
- Road and streetcar traffic volumes;
- Truck percentages;
- Vehicle speed; and
- Screening provided by existing buildings.

Sound levels due to groundside and ferry activities at the receptors were modelled using Cadna/A, which is a commercially available software implementation of the ISO 9613 [13, 14] environmental noise propagation algorithms produced by Datakustik GmbH. The following factors were taken into account:

- distance attenuation;
- source-receptor geometry;
- ground and air (atmospheric) attenuation; and,
- meteorological effects on noise propagation.

4. NOISE IMPACT ASSESSMENT

4.1 Road and LRT Traffic Noise

The noise levels associated with 2016 road and LRT traffic volumes were modelled using data summarized in Appendix C. Sample STAMSON output files for Receptor R1 are included in Appendix D. Estimates of 2010 road traffic sound levels were scaled based on the ratio of 2010 traffic volumes to 2016 traffic volumes. Changes in the noise levels due to road and LRT traffic at the modelled receptors are summarized in Table 6.

Table 6: Predicted 2010 and 2016 Road / LRT Traffic Sound Levels L_{eq} (24)

Receptor No.	2010 (dBA)	2016 (dBA)	Difference (dB)	Human Perception of Change in Levels	Significance of Change
R1	68	69	1	Imperceptible Increase	Insignificant
R2	75	75	0	No Change	Insignificant
R3	65	66	1	Imperceptible Increase	Insignificant
R4	58	59	1	Imperceptible Increase	Insignificant
R5	65	65	0	No Change	Insignificant
R6	65	66	1	Imperceptible Increase	Insignificant
R7	65	65	0	No Change	Insignificant
R8	58	59	1	Imperceptible Increase	Insignificant

The maximum increase in road traffic noise levels is predicted to be 1 dBA, for receptors R1, R3, R4, R6, and R8. The increase in noise levels at these receptors can be attributed to increased traffic along Bathurst Street and the Queen's Quay. In terms of human perception, an increase of less than 3 dBA is imperceptible, and thus is insignificant.

Predicted 2010 L_{eq} (24) hour values in the area generally range between 58 and 75 dBA, with the highest level of 75 dBA at receptor R2 due to the receptor's proximity to the Lakeshore Boulevard and Gardiner Expressway. 2016 sound levels generally range from 59 to 75 dBA, with a high of 75 dBA at R2. For areas where levels are greater than or equal to 75 dBA, new residential development will not be suitable (based on CMHC noise guidelines, Table 2) [2]. For areas where levels are less than 75 dBA, warning clauses relating to potential road traffic noise levels, central air conditioning requirements, and provisions for specific housing construction are required (under MOE LU-131 guidelines, Table 2) [1].

Predicted 2010 and 2016 daytime (0700 to 2300 h) (L_{eq} (Day)) sound levels and changes in the sound levels due to road and light rail traffic at the modelled receptors are summarized in Table 7.

Table 7: Predicted 2010 and 2016 Road / LRT Traffic Daytime Sound Levels L_{eq} (Day)

Receptor No.	2010 (dBA)	2016 (dBA)	Difference (dB)	Human Perception of Change in Levels	Significance of Change
R1	70	70	1	Imperceptible Increase	Insignificant
R2	76	77	0	No Change	Insignificant
R3	66	67	1	Imperceptible Increase	Insignificant
R4	59	60	1	Imperceptible Increase	Insignificant
R5	67	67	0	No Change	Insignificant
R6	67	68	1	Imperceptible Increase	Insignificant
R7	66	67	0	No Change	Insignificant
R8	59	60	1	Imperceptible Increase	Insignificant

Notes: Apparent arithmetic discrepancies are due to rounding.

Maximum increases between 2010 and 2016 noise levels are predicted to be less than 1 dBA, which is imperceptible, and thus is insignificant.

2010 L_{eq} (Day) values are generally predicted to range from 59 to 76 dBA within the study area, with a high value of 76 dBA at receptor R2, due to Lakeshore Boulevard and Gardiner Expressway traffic. 2016 L_{eq} (Day) values range from 60 to 77 dBA, with a high value of 77 dBA at R2. The predicted noise levels at some of the receptors (less than or equal to 75 dBA) means that new residential development in these areas would require warning clauses relating to potential road traffic noise levels, central air conditioning requirements, and provisions for specific housing construction under MOE LU-131 guidelines [1]. However, in areas where noise levels are greater than 75 dBA, new residential development in that area will be restricted.

Predicted 2010 and 2016 night-time (2300 to 0700 h) (L_{eq} (Night)) sound levels and changes in the noise levels due to road and light rail traffic at the modelled receptors are summarized in Table 8.

Table 8: Predicted 2010 and 2016 Road / LRT Traffic Night-time Sound Levels L_{eq} (Night)

Receptor No.	2010 (dBA)	2016 (dBA)	Difference (dB)	Human Perception of Change in Levels	Significance of Change
R1	64	64	1	Imperceptible Increase	Insignificant
R2	70	70	0	No Change	Insignificant
R3	61	62	1	Imperceptible Increase	Insignificant
R4	54	55	1	Imperceptible Increase	Insignificant
R5	59	59	0	No Change	Insignificant
R6	61	61	1	Imperceptible Increase	Insignificant
R7	59	59	0	No Change	Insignificant
R8	54	55	1	Imperceptible Increase	Insignificant

Notes: Apparent arithmetic discrepancies are due to rounding.

The maximum change in road and LRT traffic noise for L_{eq} (Night) values are predicted to be 1 dBA, which is considered to be imperceptible. 2016 residential development within the study area would not be restricted by MOE LU-131 guidelines [1]. Warning clauses relating to potential road traffic noise levels, central air conditioning requirements, and provisions for specific housing constructions would be required at some receptors because of road and LRT traffic.

4.2 Airside Activity Noise

Receptors within this study receive noise impacts from airside activity (aircraft in flight, landing, and take-off roll) from aircraft associated with BBTCA, as well as overflying aircraft associated with Lester B. Pearson International Airport (LBPIA).

Aircraft noise impact predictions in the vicinity of Canadian airports and associated land-use planning activities use the Noise Exposure Forecast (NEF) model developed by Transport Canada [15]. The NEF value is a complex, calculated measure of the aircraft noise based on the type of aircraft in use, the take-off and landing patterns of the aircraft, times of operation and runway configuration. The model does not include ground-based noise from aircraft other than the landing and take-off rolls. The NEF represents the noise exposure over a typical 24-hour period with a penalty applied to night-time operations. The model requires information on peak planning day aircraft movements (defined as the 95th percentile day of the year, where 100 % represents the busiest day), aircraft type, destination, runway configuration and utilization. Since there is minimal air traffic activity at night, usually restricted to air ambulance, the noise assessment assumes no noise impacts from airside activity during the night-time period.

As discussed in Section 2.2.2, under the Tripartite Agreement, the NEF 28 contours cannot extend past the Tripartite Agreement 1990 NEF 25 contour, except in areas to the southwest over Lake Ontario [7]. The Tripartite Agreement noise contours are provided in Appendix E. All residences within the study area lie outside the Tripartite Agreement 1990 NEF 25 contour.

Airside noise impacts (i.e., noise from aircraft in the air) on the identified receptors were determined by converting the NEF value for each receptor location to a L_{eq} (24) value (as measured in dBA). Estimates of 2010 airside noise levels were based on the December 2001 Sypher, Mueller report Toronto City Centre Airport General Aviation & Airport Feasibility Study [16] which developed the NEF 28 noise contours for the year 2000, and are included in Appendix F.

LBPIA contributes to the airside noise impacts within the study area. The airside noise level impacts due to the LBPIA are based on measurements of aircraft overflight noise from the original 1997 RWDI study [17]. These measured levels were added to the estimated BBTCA airside noise levels to derive a total predicted L_{eq} (24) and L_{eq} (Day) airside noise level.

As shown in Table 9, airside noise levels at the eight receptor locations for both the 2010 and 2016 years are the same as the 1990 NEF 25 contour level was used as the basis to estimate airside noise effects (because the 1990 NEF 25 contour level cannot be exceeded).

Table 9: Predicted Total Airside Noise Levels (BBTCA and LPBIA Overflight Levels in dBA)

Receptor No.	2010[1]		2016[1]	
	L_{eq} (24)	L_{eq} (Day)	L_{eq} (24)	L_{eq} (Day)
R1	55	57	55	57
R2	56	58	56	58
R3	56	58	56	58
R4	57	59	57	59
R5	56	58	56	58
R6	55	57	55	57
R7[2]	56	58	56	58
R8[3]	57	59	57	59

Notes: [1] Results were extracted from previous 2005 study.
[2] The results at R7 were assumed to be the same as R5 due to equivalent distance to BBTCA.
[3] The results at R8 were assumed to be the same as R4 due to equivalent distance to BBTCA.

All residences and passive land use areas within the study area lie outside of the Tripartite Agreement 1990 NEF 25 contour, and are therefore expected to have NEF values at or below NEF 25 for 2010 and 2016 conditions. Under current land use guidelines for new residential development, no airside aircraft noise-related restrictions are expected to apply for 2010 or 2016.

4.3 Groundside Activity Noise

The assessment of BBTCA groundside activity noise impacts included aircraft taxiing between the gate and the runway, run-up (aircraft starting up for take-off), and ground support equipment (e.g., fuel trucks, baggage handlers). These noise levels were predicted in order to determine the total cumulative sound levels for both 2010 and 2016 at the receptors of interest.

DCL provided 2010 and 2016 weekday peak planning day aircraft movements by aircraft type, which is contained in Appendix G. The 2010 and 2016 scenarios capture the local and itinerant aircraft using the airport. The local aircraft traffic is referred to as Touch and Gos (TGOs) and the itinerant aircraft traffic is referred to as Landing and Take-offs (LTOs).

TGOs refer to action by an aircraft consisting of a departure on a runway, operating in the local traffic pattern or within sight of the airport, landing without stopping and then takeoff. An aircraft can complete this procedure a number of times. TGOs aircraft ground-based activity of moving to and from the gate, taxiing to and from the runway and run-up is included within the LTOs movements contained in Appendix G. TGOs landing and taking-off after the initial takeoff and landing are not included in the ground-based noise assessment, but are included in the airside noise assessment.

There is minimal air traffic activity at night (2300h to 0700h), usually restricted to air ambulance. Groundside activity noise was included in the assessment for the nighttime period to primarily account for groundside activity in preparation for the daytime air traffic and after daytime air traffic has ceased.

The noise assessment of ground-based aircraft activity is based on the assumption that 50% of the aircraft are landing and 50% are taking off. Noise emission data for each aircraft type was based on previous 1997 measurements and data from the U.S. Federal Aviation Administration (FAA) Advisory Circular [18]. The noise emission data was used to determine run-up and taxi sound power levels for LTO activities. Sound power levels were developed from the data provided. Modelling of BBTCA included specific adjustment for speed, duration, runway utilization, time, and the number of movements. Propagation of sound to the receptors was calculated in Cadna/A, which is a commercially available software implementation of the ISO 9613 [13, 14] environmental noise propagation algorithms produced by Datakustik GmbH. Only the runways with the highest utilizations were modelled in this noise assessment. 2010 and 2016 aircraft volumes are contained in Appendix G.

Predicted 2010 and 2016 24-hour weekday average sound levels (L_{eq} (24)) and changes in the noise levels due to groundside activities at the modelled receptors are summarized in Table 10.

Table 10: Predicted 2010 and 2016 Weekday Groundside Sound Levels L_{eq} (24)

Receptor No.	2010 (dBA)	2016 (dBA)	Difference (dB)	Human Perception of Change in Levels	Significance of Change
R1	52	54	2	Imperceptible increase	Insignificant
R2	35	38	3	Imperceptible increase	Insignificant
R3	57	59	2	Imperceptible increase	Insignificant
R4	57	60	3	Imperceptible increase	Insignificant
R5	49	52	3	Imperceptible increase	Insignificant
R6	55	57	2	Imperceptible increase	Insignificant
R7	52	55	3	Imperceptible increase	Insignificant
R8	58	60	2	Imperceptible increase	Insignificant

Predicted 2010 and 2016 daytime (7:00 to 23:00) L_{eq} (Day) sound levels and changes in the noise levels due to groundside activities at the modelled receptors are summarized in Table 11.

Table 11: Predicted 2010 and 2016 Weekday Groundside Sound Levels L_{eq} (Day)

Receptor No.	2010 (dBA)	2016 (dBA)	Difference (dB)	Human Perception of Change in Levels	Significance of Change
R1	53	56	3	Imperceptible increase	Insignificant
R2	37	39	2	Imperceptible increase	Insignificant
R3	58	61	3	Imperceptible increase	Insignificant
R4	59	62	3	Imperceptible increase	Insignificant
R5	51	53	2	Imperceptible increase	Insignificant
R6	57	59	3	Imperceptible increase	Insignificant
R7	54	57	3	Imperceptible increase	Insignificant
R8	59	62	3	Imperceptible increase	Insignificant

Predicted 2010 and 2016 nighttime (23:00 to 7:00) L_{eq} (Night) sound levels and changes in the noise levels due to groundside activities at the modelled receptors are summarized in Table 12.

Table 12: Predicted 2010 and 2016 Weekday Groundside Sound Levels L_{eq} (Night)

Receptor No.	2010 (dBA)	2016 (dBA)	Difference (dB)	Human Perception of Change in Levels	Significance of Change
R1	37	39	2	Imperceptible increase	Insignificant
R2	20	22	2	Imperceptible increase	Insignificant
R3	41	44	3	Imperceptible increase	Insignificant
R4	42	45	3	Imperceptible increase	Insignificant
R5	34	36	2	Imperceptible increase	Insignificant
R6	40	42	2	Imperceptible increase	Insignificant
R7	37	40	3	Imperceptible increase	Insignificant
R8	42	45	3	Imperceptible increase	Insignificant

The results in Tables 10 and 11 show that the L_{eq} (24), L_{eq} (Day), and L_{eq} (Night) sound levels are predicted to increase. The increase is due to aircraft movements.

As discussed in Section 2.2.3, while MOE NPC-205 guidelines do not strictly apply, BBTCA groundside noise could be considered as a “stationary noise source” for the purpose of assessing potential impacts. The background ambient noise level is dominated by road and LRT noise and is significantly higher than the NPC-205 default guideline limits as seen in Section 4.1. The limits to be used therefore would be the actual background sound levels. Comparison of groundside noise levels with background sound levels is made on the basis of the L_{eq} (Day), and L_{eq} (Night) sound levels as shown in Table 13. It should be noted that Receptor R3 (Little Norway Park) is not considered to be a noise sensitive land use under MOE NPC-205 guidelines, and therefore has not been included in Table 13.

Table 13: Predicted 2010 and 2016 Weekday Groundside vs. Ambient Sound Levels

Receptor No.	2010			2016		
	Groundside Day / Night $L_{eq}(16)/L_{eq}(8)$	Ambient (Road&LRT) $L_{eq}(16)/L_{eq}(8)$	Groundside Above Ambient?	Groundside Day / Night $L_{eq}(16)/L_{eq}(8)$	Ambient (Road&LRT) $L_{eq}(16)/L_{eq}(8)$	Groundside Above Ambient?
R1	53 / 37	70 / 64	No / No	56 / 39	70 / 64	No / No
R2	37 / 20	76 / 70	No / No	39 / 22	77 / 70	No / No
R4	59 / 42	59 / 54	No / No	62 / 45	60 / 55	Yes / No
R5	51 / 34	67 / 59	No / No	53 / 36	67 / 59	No / No
R6	57 / 40	67 / 61	No / No	59 / 42	68 / 61	No / No
R7	54 / 37	66 / 59	No / No	57 / 40	67 / 59	No / No
R8	59 / 42	59 / 54	No / No	62 / 45	60 / 55	Yes / No

Ambient (road traffic) sound exposures at R4 and R8 are generally lower than at other receptors because of building screening of the Gardiner Expressway and other major arterial roads in the area. At the same time these receptors have the largest exposure to BBTCA because they are on the waterfront. 2016 daytime groundside sound levels at R4 and R8 increase more than the increase background ambient sound levels, and thus a 2 dB increase is predicted. This would be imperceptible. Impacts at the other receptors are at or below the ambient sound levels.

4.4 Ferry Noise

Potential noise impacts associated with the ferry activities were assessed. These noise levels were predicted in order to determine the total cumulative sound levels for both 2010 and 2016 at the receptors of interest. Noise impact from the ferry's horn was not evaluated since it is a warning device required for safety purposes. Idling cars are also not considered since there is a no-idling rule applicable in this area.

Ferry crossing cycles were taken from the posted schedule and the 2010 and 2016 ferry crossing frequencies were assumed to be the same. Ferry traffic occurs during the hours of 5:30 am to 12:00 am. Details on the ferry movements are contained in Appendix C.

Sound levels for the ferry were taken from the 2005 study [19], where a ferry similar in design and operation was measured in Glenorra, Ontario. The noise assessment of the ferry operations accounted for typical ferry activities such as idling, departing, and arriving. Based on the typical ferry crossing cycles and estimated travel times, the sound power levels for each activity were adjusted for distance, speed, duration, and the number of movements.

The ferry noise is assumed to stay consistent for 2010 and 2016 operations. The L_{eq} (Day), and L_{eq} (Night) are summarized in Table 14.

Table 14: Predicted 2010 and 2016 Ferry vs. Ambient Sound Levels

Receptor No.	2010			2016		
	Ferry Day / Night $L_{eq}(16)/L_{eq}(8)$	Ambient (Road&LRT) $L_{eq}(16)/L_{eq}(8)$	Groundside Above Ambient?	Ferry Day / Night $L_{eq}(16)/L_{eq}(8)$	Ambient (Road&LRT) $L_{eq}(16)/L_{eq}(8)$	Groundside Above Ambient?
R1	34 / 29	70 / 64	No / No	34 / 29	70 / 64	No / No
R2	10 / 5	76 / 70	No / No	10 / 5	77 / 70	No / No
R3	40 / 35	66 / 61	No / No	40 / 35	67 / 62	No / No
R4	40 / 35	59 / 54	No / No	40 / 35	60 / 55	No / No
R5	22 / 17	67 / 59	No / No	22 / 17	67 / 59	No / No
R6	17 / 12	67 / 61	No / No	17 / 12	68 / 61	No / No
R7	23 / 18	66 / 59	No / No	23 / 18	67 / 59	No / No
R8	36 / 30	59 / 54	No / No	36 / 30	60 / 55	No / No

The L_{eq} values for 2010 and 2016 ferry noise levels are predicted to be well below the ambient L_{eq} noise levels due to road traffic and LRT (provided in Table 13, Section 4.3). BBTCA ferry activity, as a stationary noise source, is predicted to meet MOE NPC-205 guidelines at all residential receptors.

4.5 Overall Cumulative Effects

The noise assessment included a determination of the cumulative total effects of all noise sources from road and LRT traffic, airside BBTCA and LBPIA traffic, groundside BBTCA activity, and ferry operations to the BBTCA. These sources have been combined to identify the 2016 cumulative noise levels for each receptor location within the study area. The 2016 cumulative noise levels are then compared to the cumulative 2010 sound levels to determine the change in noise levels.

The predicted 2010 and 2016 L_{eq} (24), L_{eq} (Day), L_{eq} (Night) noise levels in the study area, due to all sources discussed above, are presented in Tables 15, 16, and 17 respectively.

Table 15: Cumulative Noise Impacts - L_{eq} (24) (in dBA)

Receptor No.	2010					2016				
	Road and LRT	Ferry	Airside	Groundside	Total	Road and LRT	Ferry	Airside	Groundside	Total
R1	68	33	55	52	69	69	33	55	54	69
R2	75	9	56	35	75	75	9	56	38	75
R3	65	39	56	57	66	66	39	56	59	67
R4	58	39	57	57	62	59	39	57	60	63
R5	65	21	56	49	66	65	21	56	52	66
R6	65	16	55	55	66	66	16	55	57	67
R7	65	22	56	52	66	65	22	56	55	66
R8	58	34	57	58	62	59	34	57	60	64

Table 16: Cumulative Noise Impacts - L_{eq} (Day) (in dBA)

Receptor No.	2010					2016				
	Road and LRT	Ferry	Airside	Groundside	Total	Road and LRT	Ferry	Airside	Groundside	Total
R1	70	34	57	53	70	70	34	57	56	71
R2	76	10	58	37	76	77	10	58	39	77
R3	66	40	58	58	67	67	40	58	61	68
R4	59	40	59	59	64	60	40	59	62	65
R5	67	22	58	51	67	67	22	58	53	68
R6	67	17	57	57	68	68	17	57	59	68
R7	66	23	58	54	67	67	23	58	57	68
R8	59	36	59	59	64	60	36	59	62	65

Table 17: Cumulative Noise Impacts - L_{eq} (Night) (in dBA)

Receptor No.	2010				2016			
	Road and LRT	Ferry	Groundside	Total	Road and LRT	Ferry	Groundside	Total
R1	64	29	37	64	64	29	39	64
R2	70	5	20	70	70	5	22	70
R3	61	35	41	62	62	35	44	62
R4	54	35	42	55	55	35	45	56
R5	59	17	34	59	59	17	36	59
R6	61	12	40	61	61	12	42	61
R7	59	18	37	59	59	18	40	59
R8	54	30	42	55	55	30	45	56

The cumulative sound levels predicted at R2, are the maximum values among all modelled receptors and are due primarily to traffic along the Lakeshore Boulevard and the Gardiner Expressway. The sound levels are not representative of the impacts from the ferry.

The overall change from 2010 conditions for both L_{eq} (24), L_{eq} (Day), and L_{eq} (Night) are presented in Tables 18, 19, and 20 respectively.

Table 18: Overall Change from 2010 Conditions - L_{eq} (24)

Receptor No.	2010 (dBA)	2016 (dBA)	Difference (dB)	Human Perception of Change in Levels	Significance of Change
R1	69	69	0	No Change	Insignificant
R2	75	75	0	No Change	Insignificant
R3	66	67	1	Imperceptible Increase	Insignificant
R4	62	63	1	Imperceptible Increase	Insignificant
R5	66	66	0	No Change	Insignificant
R6	66	67	1	Imperceptible Increase	Insignificant
R7	66	66	0	No Change	Insignificant
R8	62	64	2	Imperceptible Increase	Insignificant

Table 21: Overall Change from 2010 Conditions - L_{eq} (Day)

Receptor No.	2010 (dBA)	2016 (dBA)	Difference (dB)	Human Perception of Change in Levels	Significance of Change
R1	70	71	1	Imperceptible Increase	Insignificant
R2	76	77	1	Imperceptible Increase	Insignificant
R3	67	68	1	Imperceptible Increase	Insignificant
R4	64	65	1	Imperceptible Increase	Insignificant
R5	67	68	1	Imperceptible Increase	Insignificant
R6	68	68	1	Imperceptible Increase	Insignificant
R7	67	68	1	Imperceptible Increase	Insignificant
R8	64	65	1	Imperceptible Increase	Insignificant

Table 22: Overall Change from 2010 Conditions - L_{eq} (Night)

Receptor No.	2010 (dBA)	2016 (dBA)	Difference (dB)	Human Perception of Change in Levels	Significance of Change
R1	64	64	0	No Change	Insignificant
R2	70	70	0	No Change	Insignificant
R3	62	62	0	No Change	Insignificant
R4	55	56	1	Imperceptible Increase	Insignificant
R5	59	59	0	No Change	Insignificant
R6	61	61	0	No Change	Insignificant
R7	59	59	0	No Change	Insignificant
R8	55	56	1	Imperceptible Increase	Insignificant

The estimated maximum cumulative noise level increase among the L_{eq} (24) and L_{eq} (Day) results at all receptors within the study area is 1 dBA. These changes in sound exposures are insignificant and would not be perceptible. Overall, noise levels at the receptors considered are consistent with typical noise levels near major highways in an urban centre.

5. CONCLUSIONS

5.1 2010 Scenario

Sound level impacts at adjacent points of reception have been modeled considering groundside BBTCA operations, air side operations, road traffic volumes, BBTCA ferry, and Light Rail Transit (LRT) activity.

The 2010 sound levels were estimated for the various operations as follows. Road traffic sound levels were scaled based on the ratio of 2010 traffic volumes to 2016 traffic volumes. Ferry-attributable sound levels were calculated from the 2010 TPA ferry schedule. Groundside activity including support equipment and aircraft operations on the ground were scaled based on the ratio of 2010 aircraft movements to 2016 aircraft movements. Sound levels for airborne aircraft were not specifically modeled as part of this analysis, but were assumed to be the maximum levels allowed under the Tripartite Agreement.

Sound levels due to road and LRT traffic in the area are comparable to or higher than the sound levels from groundside airport activity for both the L_{eq} (24) and L_{eq} (Day). Airside sound levels are less than the road and LRT traffic sound levels for both L_{eq} (24) and L_{eq} (Day). Road and LRT traffic is a significant contributor to the local sound environment. Activities due to BBTCA currently result in sound levels that are similar to or less than road and LRT sound levels. The combined sound level from road traffic, LRT traffic, groundside activities, and airborne aircraft activities is dominated by the traffic and LRT noise. Due to the logarithmic nature of sound, the combined sound level is approximately equal to the sound level from road traffic and the LRT.

CONSULTING ENGINEERS & SCIENTISTS

5.2 2016 Scenario

Sound level impacts at adjacent points of reception have been modeled considering groundside BBTCA operations, air side operations, 2016 road traffic volumes, BBTCA ferry, and LRT activity. Road and LRT traffic sound levels for 2016 were modeled using the ORNAMENT algorithms and STAMSON software. Predicted traffic volumes were provided by DCL, and show an increase of a 1 dB increase in sound levels. The 2016 TPA ferry schedule is expected to remain the same as the 2010 ferry schedule. Aircraft support equipment, and aircraft operations are modeled to reflect the estimated full (202) airport slots/day, resulting in an approximate 3 dB increase above the 2010 sound levels. Sound levels for airborne aircraft were not specifically modeled as part of this analysis, but were assumed to be the maximum levels allowed under the Tripartite Agreement.

The increase in sound at the points of reception adjacent to BBTCA is a result of an increase in road and LRT traffic as well as an increase in activity at BBTCA. The combined sound level from road traffic, LRT traffic, groundside activities, and airborne aircraft activities remains dominated by the traffic and LRT noise in the 2016 scenario. Due to the logarithmic nature of sound, the combined sound level is approximately equal to the sound level from road traffic and the LRT.

Specific observations and conclusions are presented below:

- The maximum change in road and LRT traffic sound levels for L_{eq} (24), L_{eq} (Day) and L_{eq} (Night) is predicted to be 1 dBA, which is considered to be imperceptible, and thus insignificant. The predicted noise levels are high enough that 2016 residential development within the study area might be restricted in certain areas due to applicable noise guidelines for land use; however, these restrictions would result from road traffic sound levels from sources such as the Gardiner Expressway.

- All residences and passive land use areas within the study area lie outside of the Tripartite Agreement 1990 NEF 25 contour, and are therefore expected to have NEF values at or below NEF 25 for 2010 and 2016 conditions. Under current land use guidelines for new residential development, no aircraft noise-related restrictions are expected to apply for the 2010 and 2016 scenarios.

- With the exception of Receptors R4 and R8, all other residential locations examined are anticipated to have 2010 and 2016 groundside sound exposure levels below that of the ambient levels (due to road and LRT traffic). Thus, considering the BBTCA ground-based activity as a "stationary" source of sound, MOE NPC-205 guidelines, which are indicative of what is generally be acceptable, are met and would continue to be met at all residential receptor locations except R4 (Little Norway Crescent) and R8 (Southwest corner of South Beach Marina Town Residences). Ambient (road traffic) sound exposures at R4 and R8 are generally lower than at other receptors because of building screening of the Gardiner Expressway and other major arterial roads in the area. At R4 and R8, sound levels from groundside activities are anticipated to be above ambient levels from road and LRT traffic by 1 dB in both the 2010 and 2016 cases. This is considered to be imperceptible. The TPA has committed to the installation of sound barriers at the BBTCA to reduce the sound contributions from groundside activity. The effect of barriers has, however, not even been included in this study.

- The 2016 ferry sound levels at all residential receptors are predicted to remain the same as the 2010 sound levels as no change in the ferry schedule is anticipated. TPA ferry activity, as a stationary source of sound, is predicted to meet MOE NPC-205 guidelines at all residential receptors.

- The combined BBTCA ground-based activity and TPA ferry activities are predicted to meet MOE NPC-205 guidelines at all residential receptor locations except at R4 and R8 for 2010 and 2016. At R4 and R8, sound levels from groundside activities are anticipated to be above ambient levels from road and LRT traffic by 1 dB in both the 2010 and 2016 cases. This is considered to be imperceptible.

- The predicted maximum cumulative sound level increase in L_{eq} (24) and L_{eq} (Day) at all modeled receptors within the study area is between 0 and 2 dBA. Changes in overall level are predominantly caused by predicted increases in road traffic sound level. Overall changes of 1 dB to 2 dB are considered to be imperceptible.

6. REFERENCES

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[2] Canada Mortgage and Housing Corporation, Document NH16-27/1981, "Road and Rail Noise: Effects on Housing", revised 1981.

[3] Canada Mortgage and Housing Corporation, Document NH17-6/1981, "New Housing and Airport Noise", revised 1981.

[4] Transport Canada, Document TP1247E, "Land Use in the Vicinity of Airports", Amendment No. 3, revised 1996.

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[7] Transport Canada, Document 117247, "Agreement Between the Corporation of the City of Toronto, the Toronto Harbour Commission, and Her Majesty the Queen in Right of Canada Represented by the Minister of Transport - Agreement to Provide for the Continued Use of Certain Parcels of Land at Toronto Island for the Purpose of a Permanent Public Airport for General Aviation and Limited Commercial STOL (Short Take-Off and Landing) Service Operations", June 30, 1983. Document is generally known as the Tripartite Agreement.

[8] Institute for Research Construction, National Research Council, and Transport Canada, Contract Report A-1505.3 (Final), "NEF Validation Study: (1) Issues Related to the Calculation of Airport Noise Contours", December 1996.

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[11] Ontario Ministry of the Environment, "Environmental Noise Assessment in Land Use Planning", 1997.

[12] Ontario Ministry of the Environment. STAMSON v5.03. "Noise Assessment and Systems Support Unit." c. 1996.

[13] ISO-9613-1. Acoustics –Attenuation of Sound during propagation outdoors. Part 1 – Calculation of the absorption of sound by the atmosphere.

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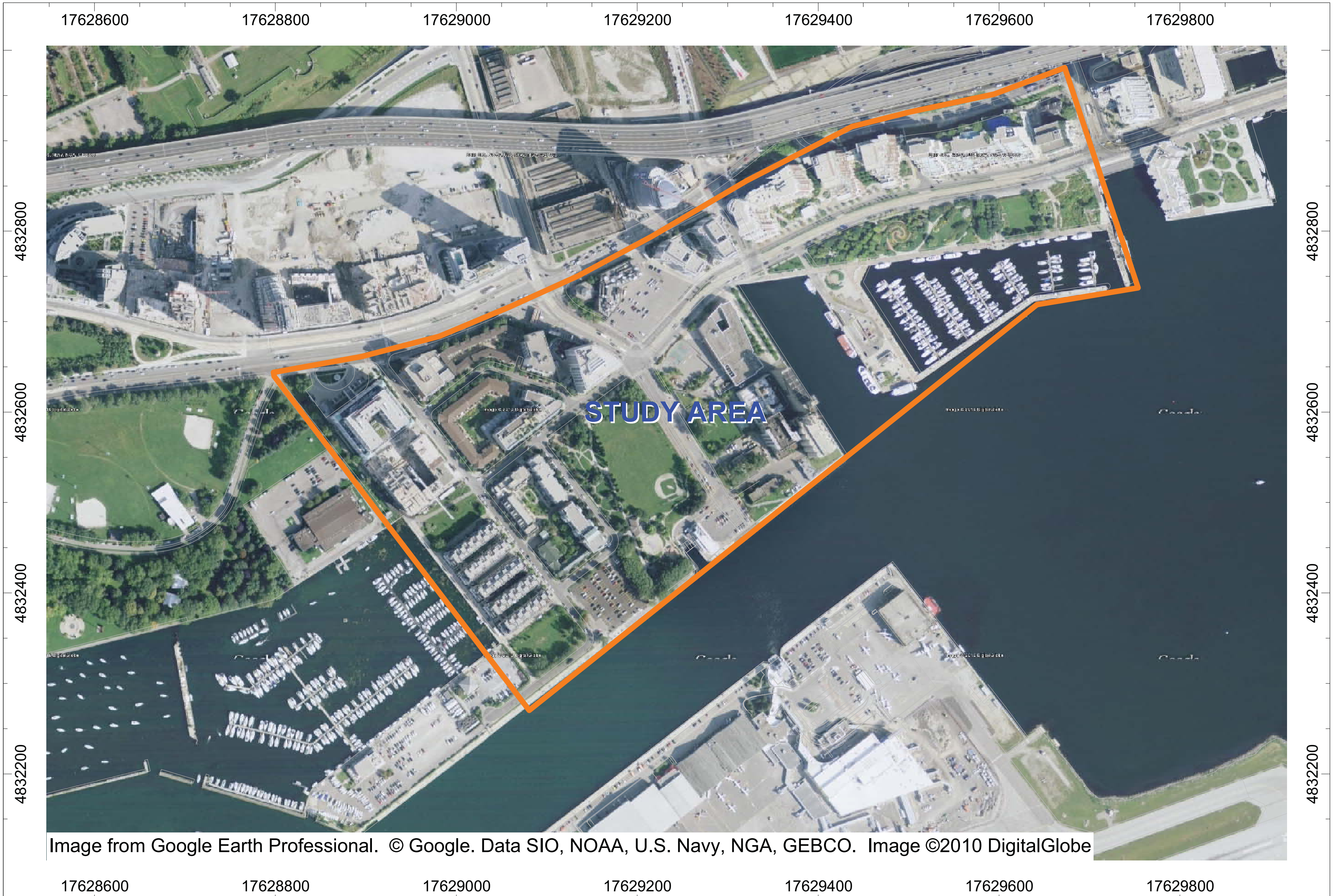
[17] RWDI Report No. 96-351-09, "Toronto City Centre Airport Aircraft Noise Study", prepared for Dillon Consulting Ltd., dated November 12, 1997.

[18] U.S. Department of Transportation, Federal Aviation Administration, "FAA Advisory Circular", No. 36-1H, November 2001.

[19] RWDI Report No. W06-5022A, "Noise Impact Assessment, Ferry Passenger Transfer Facility, Toronto City Centre Airport", prepared for Dillon Consulting Ltd., dated November 14, 2005.

FIGURES



Location of Study Area

Billy Bishop Toronto City Airport - Toronto, Ontario

True North

Project #1010187

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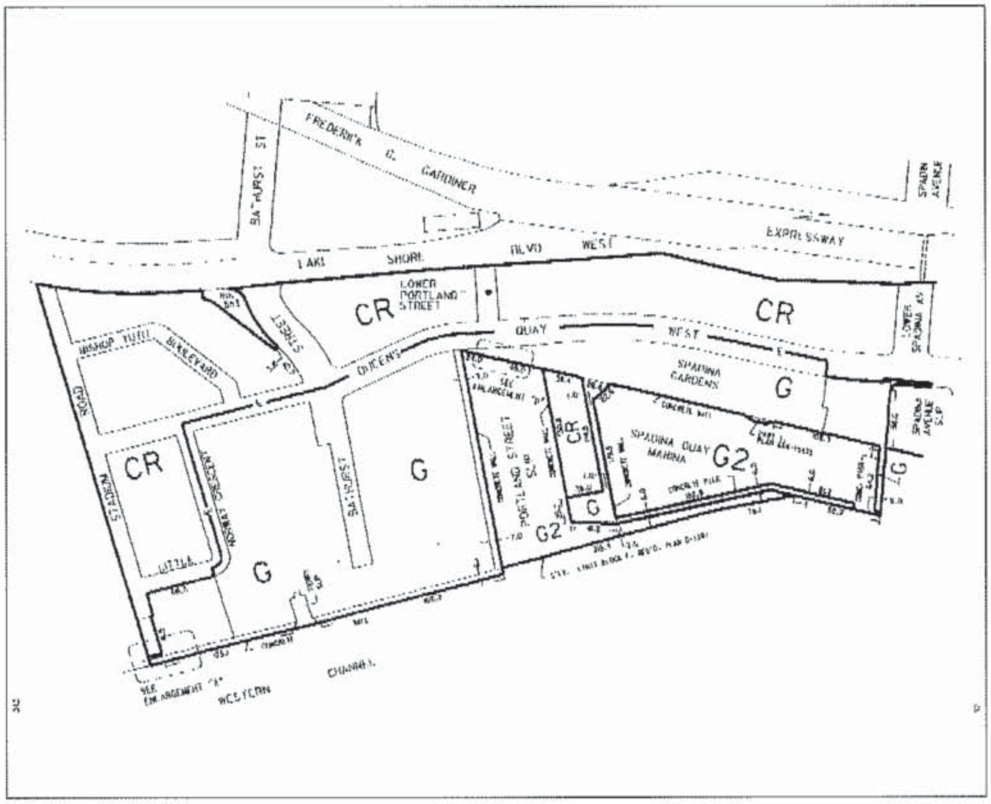
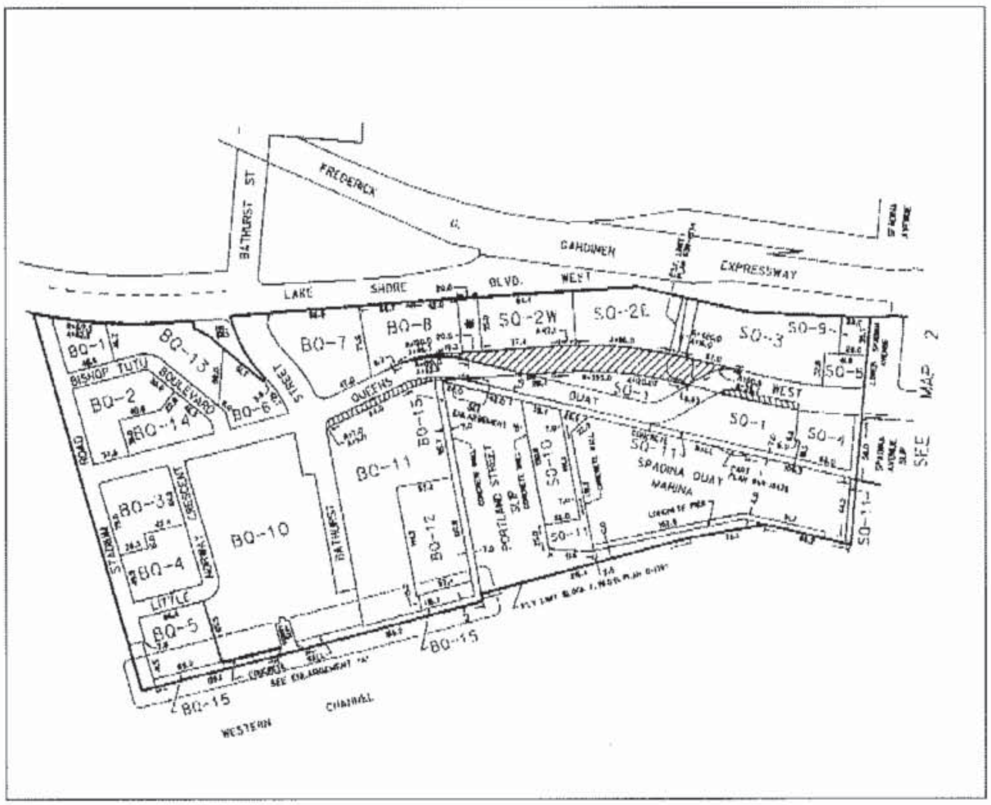
RWDI®





Zoning Maps

Ferry Passenger Transfer Facility - Toronto, Ontario   Project #W06-5022

Figure No. 2

Date: Oct. 3, 2005

RWDI

Location of Noise Receptors

Billy Bishop Toronto City Airport - Toronto, Ontario

Project #1010187

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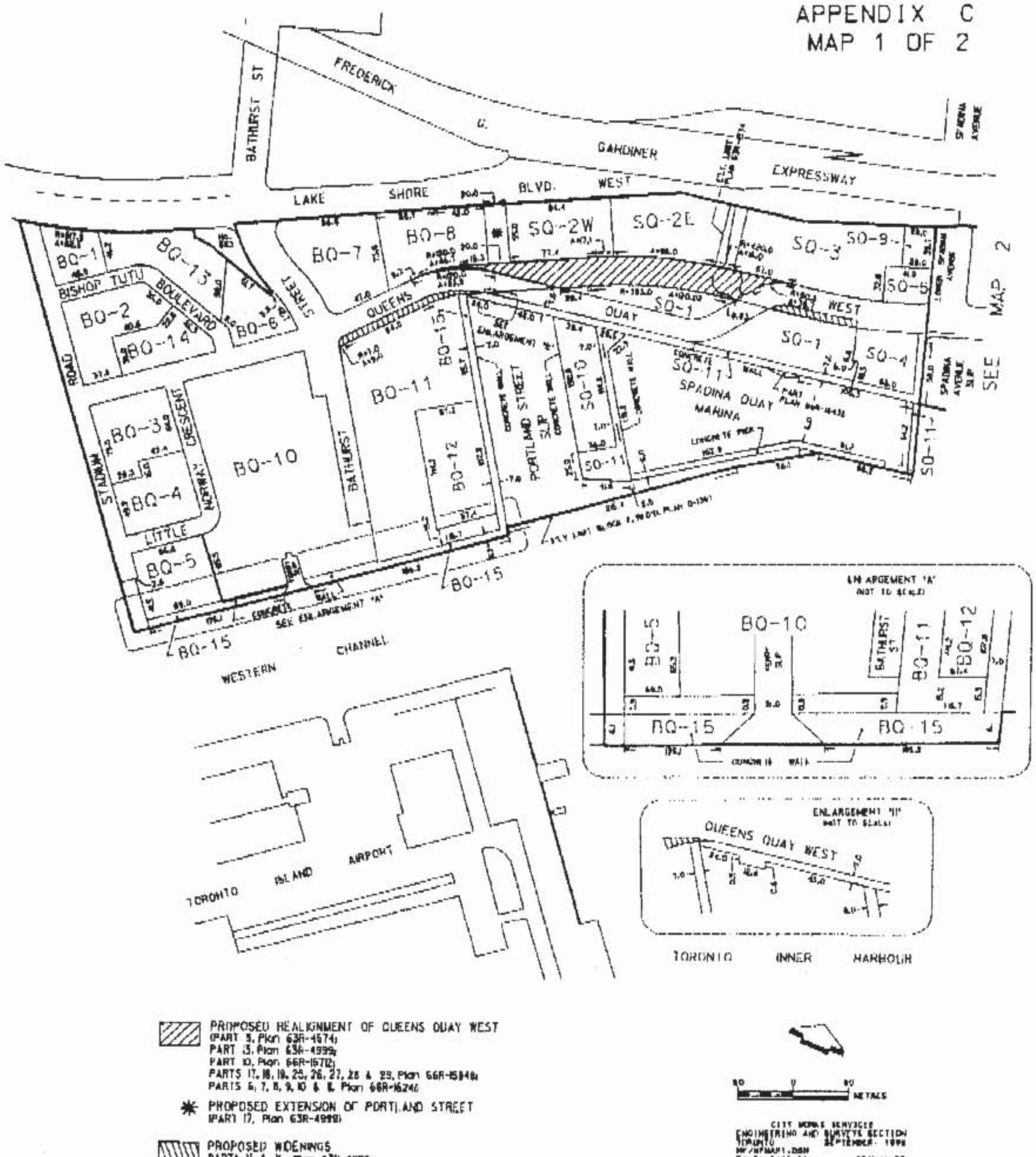
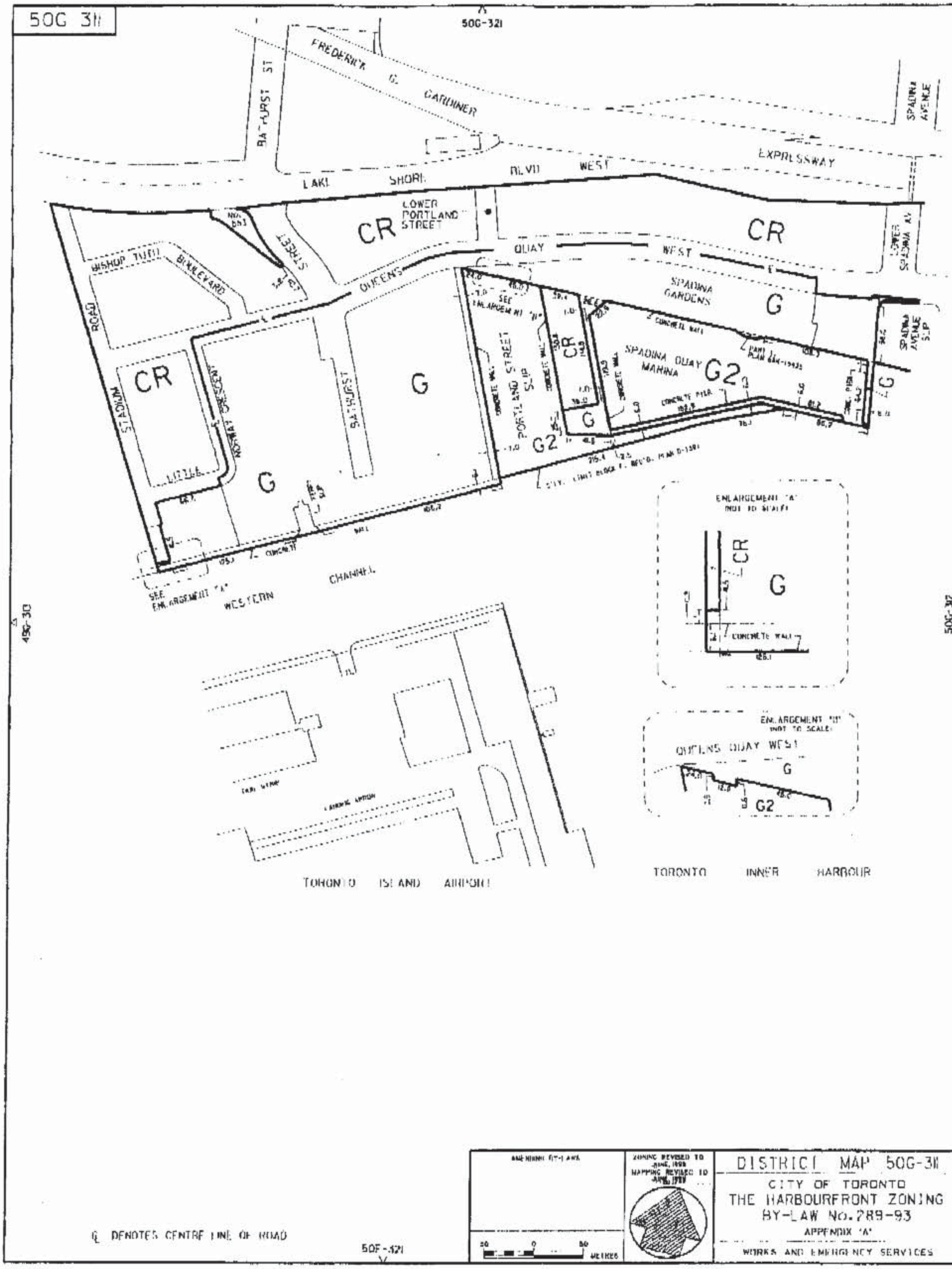
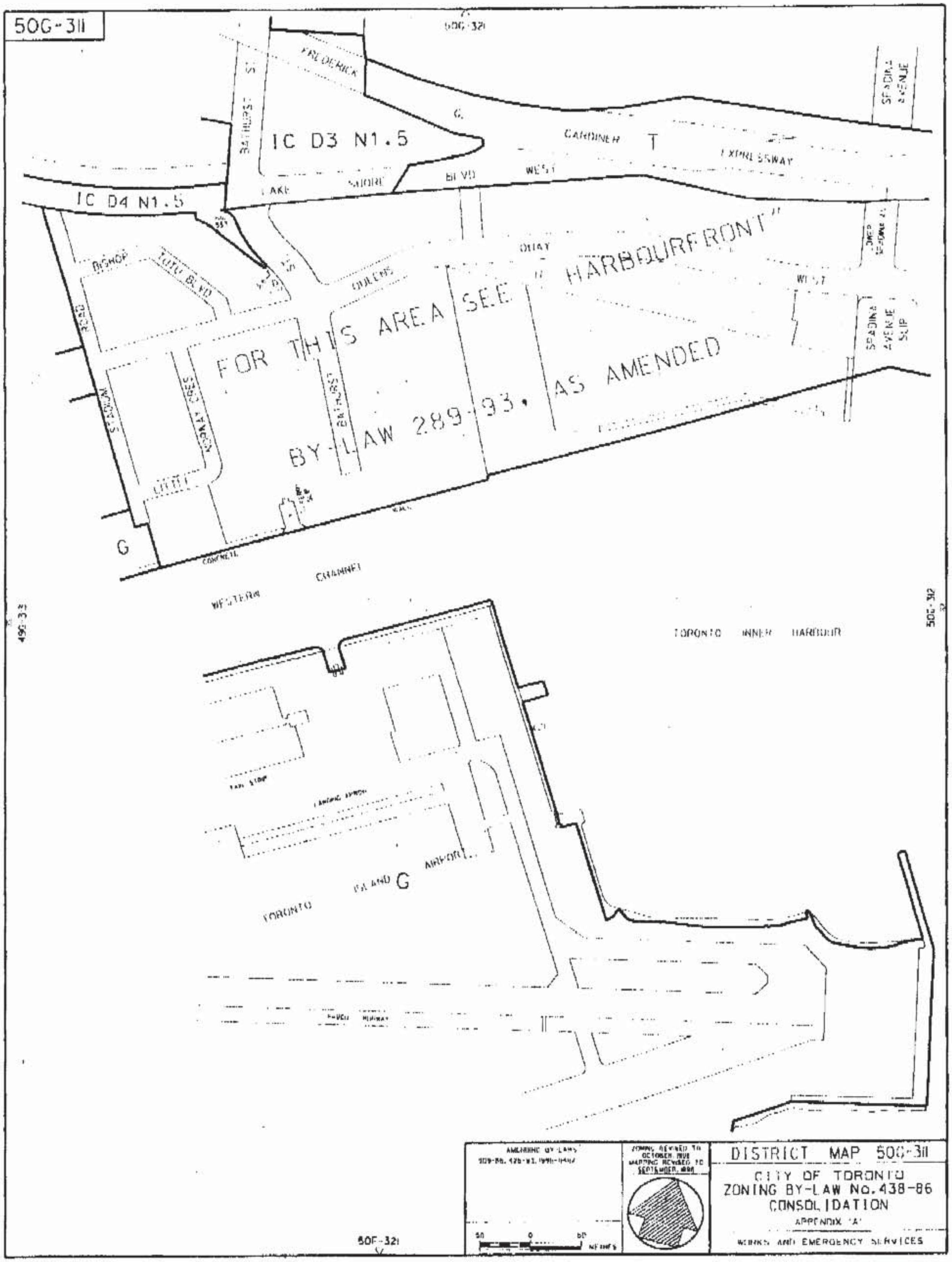
APPENDIX A

APPENDIX C
MAP 1 OF 2




50G 3II
50G-321
FREDERICK G. GARDINER EXPRESSWAY
BATHURST ST
SPADINA AVENUE
LAKE SHORE BLVD WEST
LOWER PORTLAND STREET
CR
QUEENS QUAY WEST
BISHOP TUTU BOULEVARD
STADIUM ROAD
NORWAY CRESCENT
BATHURST
G
PORTLAND STREET SLIP
SPADINA GARDENS
SPADINA QUAY MARINA
G2
CONCRETE WALL
CONCRETE PIER
LOWER SPADINA AV
SPADINA AVENUE SLIP
WESTERN CHANNEL
SEE ENLARGEMENT "A"
ENLARGEMENT "A" NOT TO SCALE
ENLARGEMENT "B" NOT TO SCALE
QUEENS QUAY WEST
TORONTO ISLAND AIRPORT
TORONTO INNER HARBOUR
49G-30
50G-312
50F-321
℄ DENOTES CENTRE LINE OF ROAD
AMENDING BY-LAWS
METRES
DISTRICT MAP 50G-311
CITY OF TORONTO
THE HARBOURFRONT ZONING BY-LAW No.289-93
APPENDIX 'A'
WORKS AND EMERGENCY SERVICES


50G-311
50G-321
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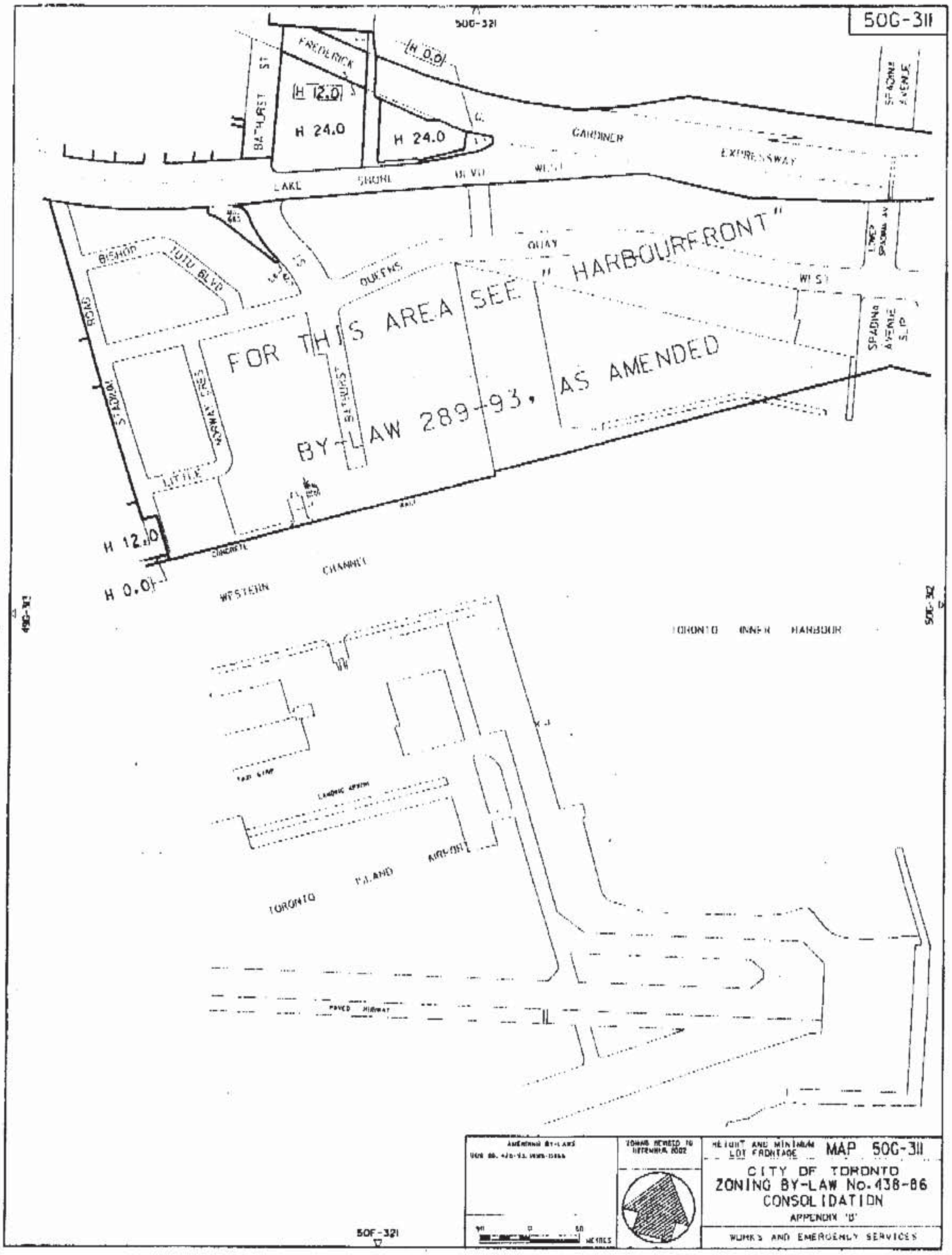
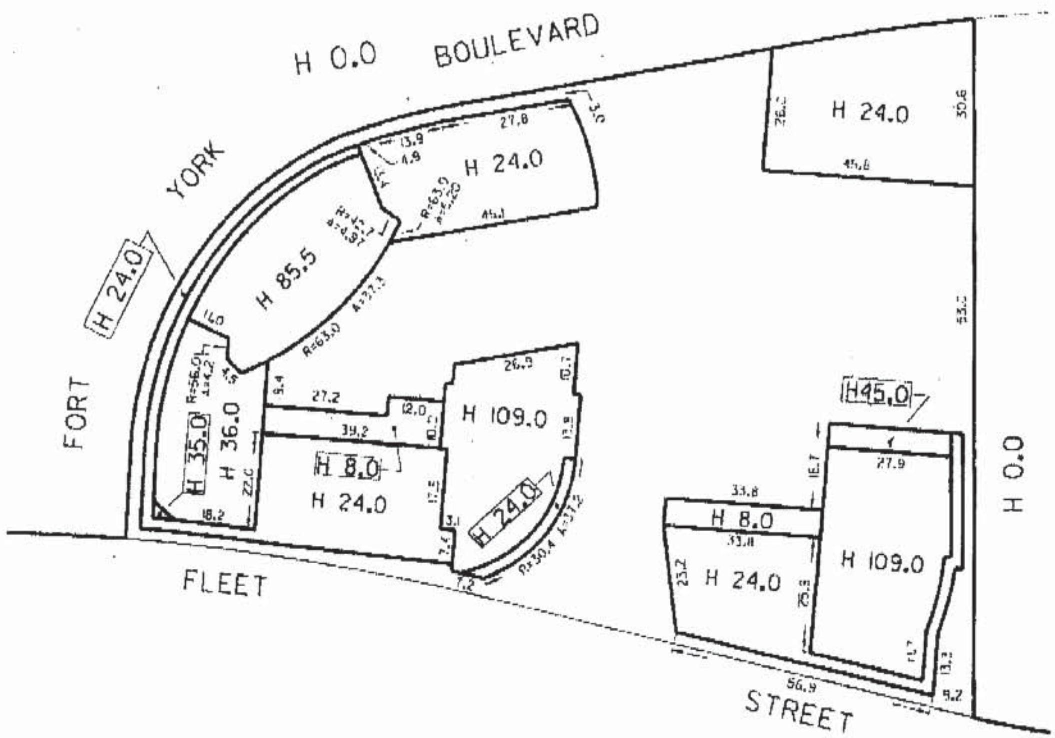
GARDINER
T
EXPRESSWAY
LAKE SHORE BLVD WEST
FREDERICK
BATHURST ST
SPADINA AVENUE
FOR THIS AREA SEE "HARBOURFRONT"
BY-LAW 289-93, AS AMENDED
BISHOP
TOTO BLVD
QUEENS QUAY WEST
BATHURST
STADIUM
ROAD
G
WESTERN CHANNEL
TORONTO INNER HARBOUR
TORONTO ISLAND AIRPORT
G
49G-33
50G-32
50F-321
DISTRICT MAP 50G-311
CITY OF TORONTO
ZONING BY-LAW No. 438-86
CONSOLIDATION
APPENDIX 'A'
WORKS AND EMERGENCY SERVICES
AMENDING BY-LAWS
METRES



50G-311
FREDERICK
H 0.0
H 12.0
H 24.0
H 24.0
BATHURST ST
GARDINER
EXPRESSWAY
LAKE SHORE BLVD WEST
SPADINA AVENUE
QUEENS QUAY WEST
FOR THIS AREA SEE "HARBOURFRONT"
BY-LAW 289-93, AS AMENDED
BISHOP TUTU BLVD
NORWAY CRES
STADIUM ROAD
LITTLE
H 12.0
H 0.0
WESTERN CHANNEL
TORONTO INNER HARBOUR
TORONTO ISLAND AIRPORT
SPADINA AVENUE SLIP
50F-321
MAP 50G-311
CITY OF TORONTO
ZONING BY-LAW No. 438-86
CONSOLIDATION
APPENDIX 'B'
WORKS AND EMERGENCY SERVICES

ATTACHMENT TO MAP 49G-313'B'



FOR ADDITIONAL DIMENSIONS. SEE BY-LAW 937-2002

WORKS AND EMERGENCY SERVICES
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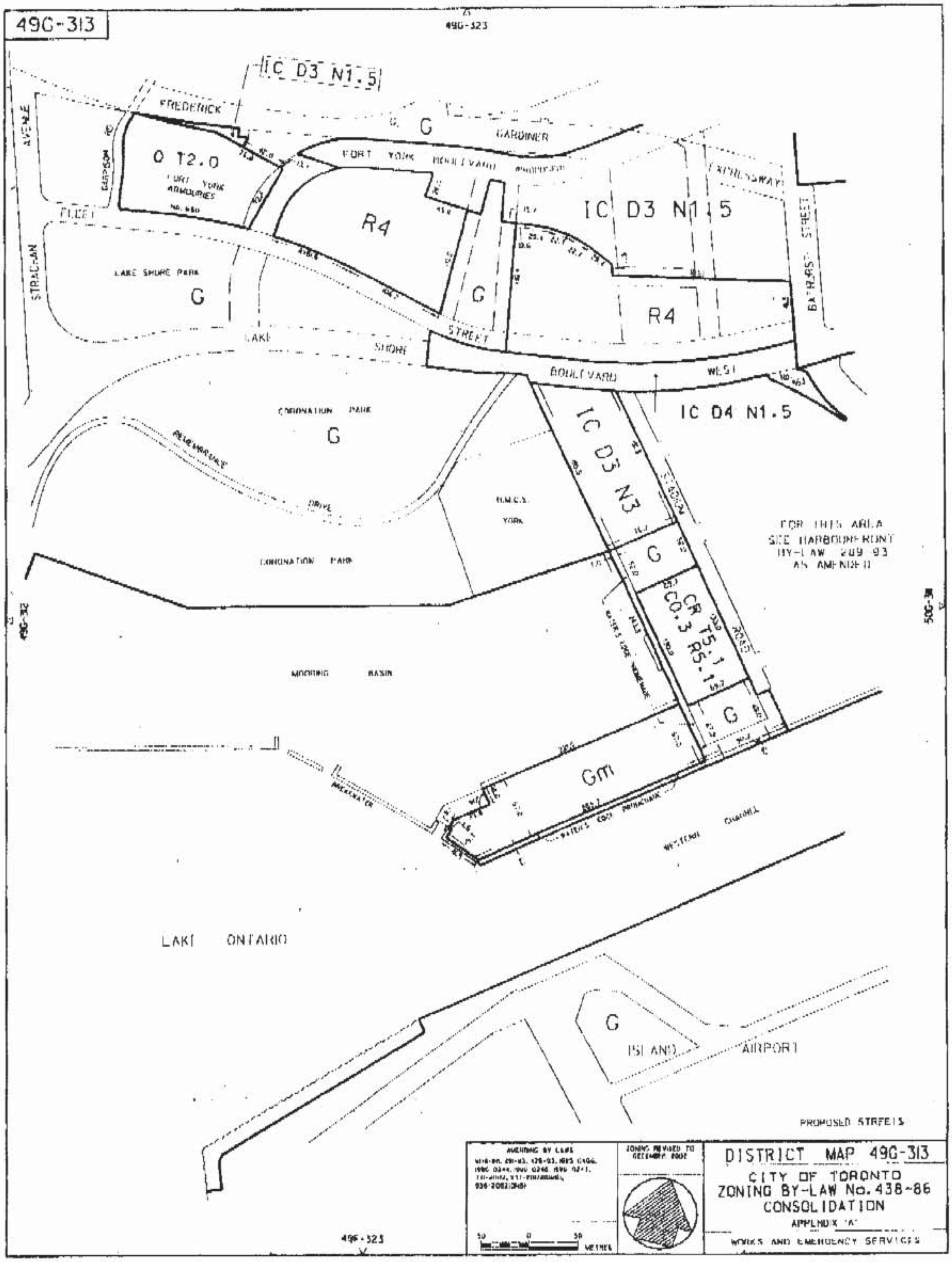
490-313
490-323
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FREDERICK
G
GARDINER
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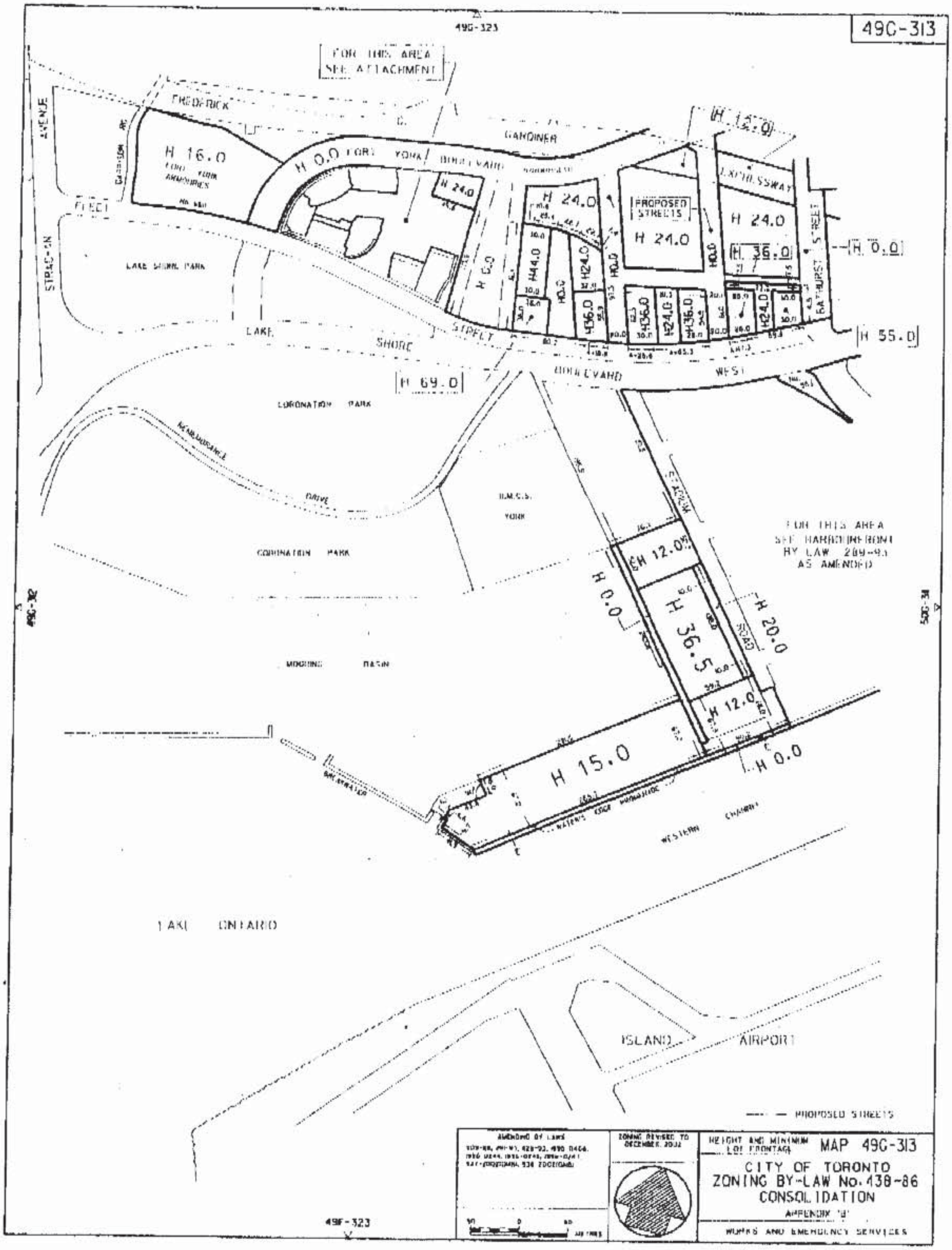
FORT YORK ARMOURIES
FORT YORK BOULEVARD
EXPRESSWAY
R4
IC D3 N1.5
STRACHAN
AVENUE
BATHURST STREET
LAKE SHORE PARK
G
G
R4
STREET
LAKE SHORE BOULEVARD WEST
IC D4 N1.5
CORONATION PARK
G
IC D3 N3
H.M.C.S. YORK
CORONATION PARK
FOR THIS AREA SEE HARBOURFRONT BY-LAW 289-93 AS AMENDED
G
CR T5.1 C0.3 R5.1
MOORING BASIN
G
Gm
WESTERN CHANNEL
LAKE ONTARIO
G
ISLAND AIRPORT
PROPOSED STREETS
ZONING REVISED TO
DISTRICT MAP 490-313
CITY OF TORONTO
ZONING BY-LAW No. 438-86
CONSOLIDATION
APPENDIX "A"
WORKS AND EMERGENCY SERVICES
METRES


49C-313
FOR THIS AREA SEE ATTACHMENT
FREDERICK
GARDINER
EXPRESSWAY
H 16.0
H 0.0
FORT YORK BOULEVARD
H 24.0
PROPOSED STREETS
H 36.0
H 0.0
BATHURST STREET
H 55.0
LAKE SHORE BOULEVARD WEST
H 69.0
LAKE SHORE PARK
CORONATION PARK
H.M.C.S. YORK
FOR THIS AREA SEE HARBOURFRONT BY LAW 289-93 AS AMENDED
H 12.0
H 36.5
H 20.0
H 15.0
MOORING BASIN
WESTERN CHANNEL
LAKE ONTARIO
ISLAND AIRPORT
PROPOSED STREETS
ZONING REVISED TO DECEMBER, 2002
HEIGHT AND MINIMUM LOT FRONTAGE
MAP 49C-313
CITY OF TORONTO
ZONING BY-LAW No. 438-86
CONSOLIDATION
APPENDIX 'B'
WORKS AND EMERGENCY SERVICES
49F-323

SECTION 3 - DISTRICTS AND ZONES

(1) For the purpose of this by-law and of the maps in Appendix "A" hereto, herein referred to as "District Maps", the following classes of use district, volume area, residential density zone, commercial, institutional and industrial density zones and non-residential density zones are hereby established, namely:

Parks Districts - G, Gh, Gm, Gr, UOS; (425-93) (1995-0492)

Residential Districts - R1, R1S, R2, R3, R4, R4A; (909-88)

Mixed-Use Districts - CR, MCR, RA, Q; (425-93) (1994-0178) (1996-0238)

Industrial Districts - I1, I2, I3, I4, IC, T, Tr; (425-93) (1995-0492)

Holding District - (h); (1996-0238)

Mixed Use Total Density Zones - T0.27, T0.5, T0.6, T1.0, T1.5, T2.0, T2.5, T3.0, T3.5, T4.0, T4.25, T5.0, T5.1, T6.0, T6.5, T6.7, T7.0, T7.8, T8.0, T12.0; (425-93) (1997-0420)

Residential Density Zones - Z0.35, Z0.38, Z0.6, Z1.0, Z1.3, Z1.5, Z2.0, Z2.5, R0, R0.6, R1.0, R1.5, R1.7, R2.0, R2.5, R3.0, R3.5, R4.0, R4.8, R5.0, R5.1, R5.5, R6.0, R6.5, R7.3, R7.8, R8.0, R11.7; (425-93) (1995-0593) (1996-0278)

Commercial, Institutional and Industrial Density Zones - C0.27, C0.3, C0.5, C0.6, C1.0, C1.5, C1.75, C2.0, C2.3, C2.5, C3.0, C4.0, C4.5, C5.0, C5.1, C5.7, C6.0, C7.0, C8.0; (425-93) (1997-0420) (1997-0422)

Non-residential Density Zones - D0.6, D1, D2, D2.5, D3, D4, D5, D6, D7; (425-93) (1995-0492)

Commercial and Institutional Density Zones - N0.5, N1, N1.5, N2, N2.5, N3, N3.5.

(425-93) (1997-0422)

SECTION 3 - DISTRICTS AND ZONES

(2) (a) The buildings and structures and uses of buildings, structures and *lots* permitted by this by-law in those districts may be referred to as: G buildings, G structures, G uses, Gh buildings, Gh structures, Gh uses, Gm buildings, Gm structures, Gm uses, Gr buildings, Gr structures, Gr uses, UOS buildings, UOS structures, UOS uses, R buildings, R structures, R uses, CR buildings, CR structures, CR uses, MCR buildings, MCR structures, MCR uses, RA buildings, RA structures, RA uses, h buildings, h structures, h uses, Q buildings, Q structures, Q uses, I buildings, I structures, I uses, IC buildings, IC structures, IC uses, T buildings, T structures, T uses, Tr buildings, Tr structures, Tr uses, the buildings, structures and uses of buildings, structures and *lots* specifically named in sections 5, 6, 7, 8, and 9 inclusive, as they appear in this by-law, respectively, may be referred to as G, Gh, Gm, Gr, UOS, R1, R1S, R2, R3, R4, R4A, CR, MCR, RA, Q, I1, I2, I3, I4, IC, T and Tr buildings, structures and uses, respectively. (1994-0178) (1995-0492) (1996-0238) (1997-0422)

(b) The expressions "G district", "Gh district", "Gm district", "Gr district", "UOS district", "R1 district", "R1S district", "R2 district", "R3 district", "R4 district", "R4A district", "CR district", "MCR district", "RA district", "(h) district", "Q district", "I1 district", "I2 district", "I3 district", "I4 district", "IC district", "T district", "Tr district", "zone 0.35 area", "zone 0.38 area", "zone 0.6 area", "zone 1.0 area", "zone 1.3 area", "zone 1.5 area", "zone 2.0 area", "zone 2.5 area", "T0.5 zone", "T0.6 zone", "T1.0 zone", "T1.5 zone", "T2.0 zone", "T2.5 zone", "T3.0 zone", "T3.5 zone", "T4.0 zone", "T4.25 zone", "T5.0 zone", "T5.1 zone", "T6.0 zone" "T6.5 zone", "T6.7 zone", "T7.0 zone", "T7.8 zone", "T8.0 zone", "T11.7 zone" "T12.0 zone", "R0 zone", "R1.5 zone", "R1.7 zone", "R2.0 zone", "R2.5 zone", "R3.0 zone", "R3.5 zone", "R4.0 zone", "R4.8 zone", "R5.0 zone", "R5.1 zone", "R5.5 zone", "R6.0 zone", "R6.5 zone", "R7.3 zone", "R7.8 zone", "R8.0 zone", "C0.3 zone", "C0.5 zone", "C0.6 zone", "C1.0 zone", "C1.5 zone", "C1.75 zone", "C2.0 zone", "C2.3 zone", "C2.5 zone", "C3.0 zone", "C4.0 zone", "C4.5 zone", "C5.0 zone", "C5.7 zone", "C6.0 zone", "C7.0 zone", "C8.0 zone", "D0.6 zone", "D1 zone", "D2 zone", "D2.5 zone", "D3 zone", "D4 zone", "D5 zone", "D6 zone", "D7 zone", "N0.5 zone", "N1 zone", "N1.5 zone", "N2 zone", "N2.5 zone", "N3 zone" and "N3.5 zone", where used in this by-law, mean, respectively, an area of the City of Toronto delineated on a District Map and designated thereon by the symbols "G", "Gh", "Gm", "Gr", "UOS", "R1", "R1S", R2", "R3", "R4", "R4A", "CR", "MCR", "RA", "h", "Q", "I1", "I2", "I3", "I4", "IC", "T", "Tr", "Z0.35", "Z0.38", "Z0.6", "Z1.0, "Z1.3", "Z1.5", "Z2.0", "Z2.5", "T0.5", "T0.6", "T1.0", "T1.5", "T2.0", "T2.5", "T3.0", "T3.5", "T4.0", "T4.25", "T5.0", "T5.1", "T6.0", "T6.5", "T6.7", "T7.0", "T7.8", "T8.0", "T12.0", "R0", "R0.6", "R1.0", "R1.5", "R1.7", "R2.0", "R2.5", "R3.0", "R3.5", "R4.0", "R4.8", "R5.0", "R5.1", "R5.5", "R6.0", "R6.5", "R7.3", "R7.8", "R8.0", "R11.7", "C0.3", "C0.5", "C0.6", "C1.0", "C1.5", "C1.75", "C2.0", "C2.3", "C2.5", "C3.0", "C4.0", "C4.5", "C5.0", "C5.1", "C5.7", "C6.0", "C7.0", "C8.0", "D0.6", "D1", "D2", "D2.5", "D3", "D4", "D5", "D6", "D7", "N0.5", "N1", "N1.5", "N2", "N2.5", "N3" and "N3.5".
(1994-0178) (1995-0492) (1995-0593) (1996-0238) (1996-0278) (1997-0422)

(425-93)

SECTION 3 - DISTRICTS AND ZONES

(3) In this subsection "permitted" means permitted in a use district pursuant to subsection (1)(c) and (d) of the section relating to the use district. Where a use, building or structure is referred to in conjunction with and attributed to a designated use district, for example, a "CR use", a "CR building", the use, building or structure is any use, building or structure, as the case may be, that is permitted in the use district, but excluding, if the use district is listed under the column headed "Use district" in the chart that follows, the uses, buildings and structures listed under the column headed "Uses, buildings and structures excluded" and set opposite the use district. (425-93)

Use district	Uses, buildings and structures excluded	
R1	Those permitted in a G district	
R1S	Those permitted in an R1 district	(909-88)
R2	Those permitted in an R1 district	
R3	Those permitted in an R2 district	
R4	Those permitted in an R3 district	
R4A	Those permitted in an R4 district	
CR	Those permitted in a G district	
MCR	Those permitted in a G district	(1994-0178)
RA	Those permitted in a G district	(1996-0238) (1997-0422)
Q	Those permitted in a G district	
I2	Those permitted in an I1 district	
I3	Those permitted in an I2 district	

(425-93)

SECTION 3 - DISTRICTS AND ZONES

(4) The City of Toronto is hereby divided into the use districts delineated on the maps in Appendix "A", referred to as "District Maps", the *height* districts and the minimum *lot frontage* districts delineated on the maps in Appendix "B" referred to as "Height and Minimum Lot Frontage Maps" and the areas delineated on the maps at the end of section 2(1), which maps, Map Area Index Appendices "A" and "B" and the information shown thereon form part of this By-law. (425-93)

APPENDIX B

ENVIRONMENTAL NOISE DESCRIPTORS AND TERMINOLOGY

Ambient or Background Noise: The ambient noise from all sources other than the sound of interest (i.e. sound other than that being measured). Under most MOE guidelines, aircraft overflights and train noise, due to their transient nature, are normally excluded from measurements of background noise.

dB - Decibel: The logarithmic units associated with sound pressure level, sound power level, or acceleration level. See sound pressure level, for example.

dBA - Decibel, A-Weighted: The logarithmic units associated with a sound pressure level, where the sound pressure signal has been filtered using a frequency weighting that mimics the response of the human ear. The resultant sound pressure level is therefore representative of the subjective response of the human ear. A-weighted sound pressure levels are denoted by the suffix 'A' (ie. dBA), and the term pressure is normally omitted from the description (i.e., sound level or noise level).

Effective Perceived Noise Level (EPNdB): A complex measure of perceived noisiness derived by making adjustments to the magnitude of measured sound levels in narrow frequency bands, (1/3 octaves) for tonality, and rise time of the noise. EPNdB values are the base measure of an individual overflight noise exposure from aircraft under the NEF metric, analogous to the manner in which SEL is used for computing $L_{eq}(24)$.

Energy Equivalent Sound Level (L_{eq}): An energy-average sound level taken over a specified period of time. It represents the average sound pressure encountered for the period. The time period is often added as a suffix to the label (i.e., $L_{eq}(24)$ for the 24-hour equivalent sound level). L_{eq} is usually A-weighted. An L_{eq} value expressed in dBA is a good, single value descriptor of the annoyance of noise.

Exceedance Noise Level (L_N): The noise level exceeded N% of the time. It is a statistical measure of the noise level. For highly varying sounds, the L_{90} represents the background noise level, L_{50} represents the median or typical noise level, and L_{10} represents the short term peak noise levels, such as those due to occasional traffic or a barking dog.

Human Perception of Sound: The human perception of noise impact is an important consideration in qualifying the noise effects caused by projects. The following table presents a general guideline.

Increase in Noise Level (dBA)	Perception
0 to 3	insignificant due to imperceptibility
3 to 5	just-noticeable difference
6 to 9	marginally significant
10 or more	significant, perceived as a doubling of sound exposure

Noise: Unwanted sound.

Noise Level: Same as Sound Level, except applied to unwanted sounds.

Noise Exposure Forecast (NEF): A calculated measure of aircraft noise based on the type of aircraft in use, the take-off and landing patterns of the aircraft, and times of operation. It represents the noise exposure over a typical 24 hour period. A penalty is applied to nighttime operation.
Peak Sound Pressure Level: Same as Sound Pressure Level except that peak (not peak-to-peak) sound pressure values are used in place of RMS pressures.

Quasi-Steady Impulsive Noise: Noise composed of a series of short, discrete events, characterized by rapid rise times, but with less than 0.5 seconds elapsing between events.

RMS Sound Pressure: The square-root of the mean-squared pressure of a sound (usually the result of an RMS detector on a microphone signal).

Sound: a dynamic (fluctuating) pressure.

Sound Exposure Level (SEL): An L_{eq} referenced to a one second duration. Also known as the Single Event Level. It is a measure of the cumulative noise exposure for a single event. It provides a measure of the accumulation of sound energy over the duration of the event.

Sound Level (SL): The A-weighted Sound Pressure Level expressed in dBA.

Sound Pressure Level (SPL): The logarithmic ratio of the RMS sound pressure to the sound pressure at the threshold of hearing. The sound pressure level is defined by equation (1) where P is the RMS pressure due to a sound and P_0 is the reference pressure. P_0 is usually taken as 2.0×10^{-5} Pascals.

$$\textbf{(1)} \quad \text{SPL (dB)} = 20 \log(P_{RMS}/P_0)$$

Sound Power Level (PWL): The logarithmic ratio of the instantaneous sound power (energy) of a noise source to that of an international standard reference power. The sound power level is defined by equation (2) where W is the sound power of the source in watts, and W_0 is the reference power of 10^{-12} watts.

$$\textbf{(2)} \quad \text{PWL (dB)} = 10 \log(W/W_0)$$

Interrelationships between sound pressure level (SPL) and sound power level (PWL) depend on the location and type of source.

APPENDIX C

APPENDIX C

ROAD, RAIL AND FERRY VOLUMES

Road Traffic Volumes

On August 16, 2010, DCL provided current (2010) and future (2016) annual average daily traffic (AADT) counts for Lakeshore Blvd, Queens Quay, Gardiner Expressway, Stadium Rd, Bathurst St, and Spadina Ave in the vicinity of the study area. Based on the previous noise assessment for BBTCA, a daytime/night-time split of 94/6 was assumed for all roads except for the Gardiner Expressway which was assumed to have a daytime/night-time split of 88/12. Heavy/Medium truck percentages were not provided in the current or future traffic volumes, and have been assumed to be the same as breakdowns used in the previous study. Traffic volumes are summarized in Table C1.

Table C1 – Existing and Future Traffic Volume Summary

Roadway Descriptions	Direction	Current AADT		Future AADT (2016)		Medium / Heavy Truck Percentage	Day/Night Split
Lakeshore Boulevard Stadium Rd. to Bathurst St.	EB	42,500	15,314	45,500	16,395	5.3 % M	94/6
	WB		27,186		29,105	8.5 % H	
Lakeshore Boulevard Bathurst St. to Spadina Rd.	EB	37,500	17,133	39,500	18,047	2.1 % M	94/6
	WB		20,367		21,453	3.3 % H	
Bathurst Street Lakeshore Blvd. to Queens Quay	NB	7,500	3,728	10,500	5,219	3.8 % M	94/6
	SB		3,772		5,281	6.0 % H	
Bathurst Street Lakeshore Blvd. to Gardiner Expressway	NB	20,000	12,787	22,500	14,385	5.9 % M	94/6
	SB		7,213		8,115	9.4 % H	
Bathurst Street Queens Quay to Lake Ontario	NB	5,000	2,583	8,500	4,391	3.2 % M	94/6
	SB		2,417		4,109	5.1 % H	
Queens Quay Stadium Rd. to Bathurst St.	EB	3,500	1,448	3,500	1,448	2.9 % M	94/6
	WB		2,052		2,052	4.6 % H	
Queens Quay Bathurst St. to Spadina Rd.	EB	10,500	3,165	12,000	3,617	3.9 % M	94/6
	WB		7,335		8,383	6.2 % H	
Gardiner Expressway Stadium Rd. to Spadina Rd.	EB	160,000	79,758	164,000	81,752	5 % M	88/12
	WB		80,242		82,248	8 % H	
Stadium Road Lakeshore Blvd. to Queens Quay	NB	4,500	3,587	4,500	3,587	2.3 % M	94/6
	SB		913		913	3.6 % H	
Stadium Road Queens Quay to Lake Ontario	NB/SB	2,000	2,000	2,000	2,000	2.5 % M 6.5 % H	94/6

Light Rail Traffic (Streetcars)

The Harbourfront and Bathurst Streetcar Lines operate within the study area. The Bathurst Street Streetcar Line consist of one northbound and one southbound track. The Harbourfront Streetcar Line consists of one eastbound and one westbound track. The Toronto Transit Commission (TTC) existing schedules for these Streetcar Lines were used to determine the total number of streetcars within the study area during a 24-hour period. These volumes were projected to the year 2016 using a standard yearly growth rate of 2.5 percent. The existing and future (2016) 24-hour traffic volumes are summarized in Table C2.

Table C2 – Light Rail Traffic Volumes

Line	Existing No. of Trains	Future (2016) No. of Trains	Max. Speed (km/hr)	Day/Night Split
Harbourfront	322	382	50	89/11
Bathurst	370	439	50	82/18

Passenger Ferry

The ferry operating schedule was obtained from the TPA website. Ferry operations are not expected to change between the existing year and 2016. The ferry operates during the majority of the day on a 15-minute schedule to provide four roundtrips per hour. Table C3 details ferry operations.

Table C3 – Ferry operations

From Mainland	From airport
5:30	5:37
5:45	5:52
6:00	6:07
6:15	6:22
6:30	6:37
6:30 to 22:45 – Every 15 minutes	
22:45	22:52
23:00	23:07
23:15	23:22
23:30	23:37
23:45	24:00

APPENDIX D

```
STAMSON 5.0        NORMAL REPORT        Date: 19-10-2010 16:29:21
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r1fut114.te          Time Period: 24 hours
Description: Receptor R1, Future, Part 1


Road data, segment # 1: GE EB1
------------------------------
Car traffic volume  : 71124 veh/TimePeriod  *
Medium truck volume :  4088 veh/TimePeriod  *
Heavy truck volume  :  6540 veh/TimePeriod  *
Posted speed limit  :    90 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 1: GE EB1
----------------------------
Angle1   Angle2           : -57.00 deg   -2.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 238.00 m
Receiver height           :   1.50 m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -51.00 deg   Angle2 : -12.00 deg
Barrier height            :  18.30 m
Barrier receiver distance : 110.00 m
Source elevation          :  13.70 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

♀
Road data, segment # 2: GE WB1
------------------------------
Car traffic volume  : 71556 veh/TimePeriod  *
Medium truck volume :  4112 veh/TimePeriod  *
Heavy truck volume  :  6580 veh/TimePeriod  *
Posted speed limit  :    90 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 2: GE WB1
----------------------------
Angle1   Angle2           : -55.00 deg   -4.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 250.00 m
Receiver height           :   1.50 m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -53.00 deg   Angle2 : -14.00 deg
Barrier height            :  18.30 m
Barrier receiver distance : 125.00 m
Source elevation          :  13.70 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

♀
Road data, segment # 3: GE EB2
------------------------------
Car traffic volume  : 71124 veh/TimePeriod  *
Medium truck volume :  4088 veh/TimePeriod  *
Heavy truck volume  :  6540 veh/TimePeriod  *
Posted speed limit  :    90 km/h
Road gradient       :     0 %
```

```
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 3: GE EB2
----------------------------
Angle1   Angle2           : -62.00 deg   -47.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 300.00 m
Receiver height           :   1.50 m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

♀
Road data, segment # 4: GE WB2
------------------------------
Car traffic volume  : 71556 veh/TimePeriod  *
Medium truck volume :  4112 veh/TimePeriod  *
Heavy truck volume  :  6580 veh/TimePeriod  *
Posted speed limit  :    90 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 4: GE WB2
----------------------------
Angle1   Angle2           : -62.00 deg   -43.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 310.00 m
Receiver height           :   1.50 m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

♀
Road data, segment # 5: LS BtS EB1
----------------------------------
Car traffic volume  : 17072 veh/TimePeriod  *
Medium truck volume :   379 veh/TimePeriod  *
Heavy truck volume  :   596 veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 5: LS BtS EB1
--------------------------------
Angle1   Angle2           : -28.00 deg   28.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 130.00 m
Receiver height           :   1.50 m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -21.00 deg   Angle2 : 19.00 deg
Barrier height            :  18.30 m
Barrier receiver distance :  80.00 m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

♀
Road data, segment # 6: LS StB EB2
----------------------------------
Car traffic volume  : 14132 veh/TimePeriod  *
Medium truck volume :   869 veh/TimePeriod  *
Heavy truck volume  :  1394 veh/TimePeriod  *
Posted speed limit  :    60 km/h
```

```
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 6: LS StB EB2
--------------------------------
Angle1   Angle2           : -42.00 deg   -28.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 130.00 m
Receiver height           :   1.50 m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

♀
Road data, segment # 7: LS BtS WB1
----------------------------------
Car traffic volume  : 20295 veh/TimePeriod  *
Medium truck volume :   451 veh/TimePeriod  *
Heavy truck volume  :   708 veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 7: LS BtS WB1
--------------------------------
Angle1   Angle2           : -28.00 deg   28.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 140.00 m
Receiver height           :   1.50 m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -21.00 deg   Angle2 : 19.00 deg
Barrier height            :  18.30 m
Barrier receiver distance :  80.00 m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

♀
Road data, segment # 8: LS StB WB2
----------------------------------
Car traffic volume  : 25089 veh/TimePeriod  *
Medium truck volume :  1543 veh/TimePeriod  *
Heavy truck volume  :  2474 veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 8: LS StB WB2
--------------------------------
Angle1   Angle2           : -42.00 deg   -28.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 140.00 m
Receiver height           :   1.50 m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

♀
Results segment # 1: GE EB1
---------------------------

Source height = 1.68 m
```

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.68	1.50	7.92	7.92

ROAD (53.51 + 45.28 + 55.73) = 58.01 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-57	-51	0.00	80.29	0.00	-12.00	-14.77	0.00	0.00	0.00	53.51
-51	-12	0.00	80.29	0.00	-12.00	-6.64	0.00	0.00	-16.36	45.28
-12	-2	0.00	80.29	0.00	-12.00	-12.55	0.00	0.00	0.00	55.73

Segment Leq : 58.01 dBA

♀
Results segment # 2: GE WB1

Source height = 1.68 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.68	1.50	8.44	8.44

ROAD (48.55 + 45.88 + 55.54) = 56.71 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-55	-53	0.00	80.31	0.00	-12.22	-19.54	0.00	0.00	0.00	48.55
-53	-14	0.00	80.31	0.00	-12.22	-6.64	0.00	0.00	-15.58	45.88
-14	-4	0.00	80.31	0.00	-12.22	-12.55	0.00	0.00	0.00	55.54

Segment Leq : 56.71 dBA

♀
Results segment # 3: GE EB2

Source height = 1.68 m

ROAD (0.00 + 56.49 + 0.00) = 56.49 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-62	-47	0.00	80.29	0.00	-13.01	-10.79	0.00	0.00	0.00	56.49

Segment Leq : 56.49 dBA

♀
Results segment # 4: GE WB2

Source height = 1.68 m

ROAD (0.00 + 57.40 + 0.00) = 57.40 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-62	-43	0.00	80.31	0.00	-13.15	-9.77	0.00	0.00	0.00	57.40

Segment Leq : 57.40 dBA

♀
Results segment # 5: LS BtS EB1

Source height = 1.35 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.35	1.50	1.41	1.41

ROAD (44.15 + 31.72 + 45.24) = 47.85 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-28	-21	0.00	67.63	0.00	-9.38	-14.10	0.00	0.00	0.00	44.15
-21	19	0.00	67.63	0.00	-9.38	-6.53	0.00	0.00	-20.00	31.72
19	28	0.00	67.63	0.00	-9.38	-13.01	0.00	0.00	0.00	45.24

Segment Leq : 47.85 dBA

♀
Results segment # 6: LS StB EB2

Source height = 1.71 m

ROAD (0.00 + 49.79 + 0.00) = 49.79 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-42	-28	0.00	70.26	0.00	-9.38	-11.09	0.00	0.00	0.00	49.79

Segment Leq : 49.79 dBA

♀
Results segment # 7: LS BtS WB1

Source height = 1.35 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.35	1.50	1.41	1.41

ROAD (44.58 + 32.15 + 45.67) = 48.28 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-28	-21	0.00	68.38	0.00	-9.70	-14.10	0.00	0.00	0.00	44.58
-21	19	0.00	68.38	0.00	-9.70	-6.53	0.00	0.00	-20.00	32.15
19	28	0.00	68.38	0.00	-9.70	-13.01	0.00	0.00	0.00	45.67

Segment Leq : 48.28 dBA

♀
Results segment # 8: LS StB WB2

Source height = 1.71 m

ROAD (0.00 + 51.96 + 0.00) = 51.96 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-42	-28	0.00	72.75	0.00	-9.70	-11.09	0.00	0.00	0.00	51.96

Segment Leq : 51.96 dBA

Total Leq All Segments: 63.94 dBA

♀

TOTAL Leq FROM ALL SOURCES: 63.94
♀
♀

```
Filename: r1fut214.te          Time Period: 24 hours
Description: Receptor R1, Future, Part 2


Road data, segment # 1: QQ BtS WB1
----------------------------------
Car traffic volume  :  7536 veh/TimePeriod  *
Medium truck volume :   327 veh/TimePeriod  *
Heavy truck volume  :   520 veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 1: QQ BtS WB1
--------------------------------
Angle1   Angle2           : -28.00 deg   80.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  22.00 m
Receiver height           :   1.50 m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

♀
Road data, segment # 2: QQ BtS EB1
----------------------------------
Car traffic volume  :  3252 veh/TimePeriod  *
Medium truck volume :   141 veh/TimePeriod  *
Heavy truck volume  :   224 veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 2: QQ BtS EB1
--------------------------------
Angle1   Angle2           : -28.00 deg   85.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  15.00 m
Receiver height           :   1.50 m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

♀
Road data, segment # 3: QQ BtS WB2
----------------------------------
Car traffic volume  :  7536 veh/TimePeriod  *
Medium truck volume :   327 veh/TimePeriod  *
Heavy truck volume  :   520 veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 3: QQ BtS WB2
--------------------------------
Angle1   Angle2           :  55.00 deg   70.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  64.00 m
Receiver height           :   1.50 m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
♀
Road data, segment # 4: QQ BtS EB2
----------------------------------
Car traffic volume  :  3252 veh/TimePeriod  *
Medium truck volume :   141 veh/TimePeriod  *
Heavy truck volume  :   224 veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 4: QQ BtS EB2
--------------------------------
Angle1   Angle2           :  60.00 deg   70.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  48.00 m
Receiver height           :   1.50 m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

♀
Road data, segment # 5: QQ StB EB/WB
------------------------------------
Car traffic volume  :  3238 veh/TimePeriod  *
Medium truck volume :   102 veh/TimePeriod  *
Heavy truck volume  :   161 veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 5: QQ StB EB/WB
----------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  15.00 m
Receiver height           :   1.50 m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

♀
Road data, segment # 6: BS1 LtQ
-------------------------------
Car traffic volume  :  9471 veh/TimePeriod  *
Medium truck volume :   399 veh/TimePeriod  *
Heavy truck volume  :   630 veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 6: BS1 LtQ
-----------------------------
Angle1   Angle2           :  76.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  15.00 m
Receiver height           :   1.50 m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

♀
Road data, segment # 7: BS2 QtLO
--------------------------------
Car traffic volume  :  7795 veh/TimePeriod  *
```

```
Medium truck volume :   272 veh/TimePeriod  *
Heavy truck volume  :   434 veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 7: BS2 QtLO
------------------------------
Angle1   Angle2           : -85.00 deg   52.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  15.00 m
Receiver height           :   1.50 m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

♀
Results segment # 1: QQ BtS WB1
-------------------------------

Source height = 1.58 m

ROAD (0.00 + 59.24 + 0.00) = 59.24 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -28     80   0.00  63.12   0.00  -1.66  -2.22   0.00   0.00   0.00  59.24
----------------------------------------------------------------------------

Segment Leq : 59.24 dBA

♀
Results segment # 2: QQ BtS EB1
-------------------------------

Source height = 1.58 m

ROAD (0.00 + 57.44 + 0.00) = 57.44 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -28     85   0.00  59.46   0.00   0.00  -2.02   0.00   0.00   0.00  57.44
----------------------------------------------------------------------------

Segment Leq : 57.44 dBA

♀
Results segment # 3: QQ BtS WB2
-------------------------------

Source height = 1.58 m

ROAD (0.00 + 46.03 + 0.00) = 46.03 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
    55     70   0.00  63.12   0.00  -6.30 -10.79   0.00   0.00   0.00  46.03
----------------------------------------------------------------------------

Segment Leq : 46.03 dBA

♀
Results segment # 4: QQ BtS EB2
-------------------------------

Source height = 1.58 m

ROAD (0.00 + 41.86 + 0.00) = 41.86 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
```

60	70	0.00	59.46	0.00	-5.05	-12.55	0.00	0.00	0.00	41.86

Segment Leq : 41.86 dBA

♀
Results segment # 5: QQ StB EB/WB

Source height = 1.46 m

ROAD (0.00 + 58.25 + 0.00) = 58.25 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	58.25	0.00	0.00	0.00	0.00	0.00	0.00	58.25

Segment Leq : 58.25 dBA

♀
Results segment # 6: BS1 LtQ

Source height = 1.57 m

ROAD (0.00 + 54.59 + 0.00) = 54.59 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
76	90	0.00	65.68	0.00	0.00	-11.09	0.00	0.00	0.00	54.59

Segment Leq : 54.59 dBA

♀
Results segment # 7: BS2 QtLO

Source height = 1.50 m

ROAD (0.00 + 63.02 + 0.00) = 63.02 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-85	52	0.00	64.20	0.00	0.00	-1.19	0.00	0.00	0.00	63.02

Segment Leq : 63.02 dBA

Total Leq All Segments: 66.44 dBA

♀
RT/Custom data, segment # 1: HARBOUR FT1

1 - CLRV:
Traffic volume : 382 veh/TimePeriod
Speed : 50 km/h

Data for Segment # 1: HARBOUR FT1

```
Angle1   Angle2           : -28.00 deg   82.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  18.00 m
Receiver height           :   1.50 m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

♀

```
RT/Custom data, segment # 2: HARBOUR FT2
----------------------------------------
1 - CLRV:
Traffic volume    :   382 veh/TimePeriod
Speed             :    50 km/h

Data for Segment # 2: HARBOUR FT2
---------------------------------
Angle1   Angle2            :  58.00 deg   70.00 deg
Wood depth                 :      0       (No woods.)
No of house rows           :      0
Surface                    :      2       (Reflective ground surface)
Receiver source distance   :  52.00 m
Receiver height            :   1.50 m
Topography                 :      1       (Flat/gentle slope; no barrier)
Reference angle            :   0.00

♀
RT/Custom data, segment # 3: HARBOUR FT3
----------------------------------------
1 - CLRV:
Traffic volume    :   382 veh/TimePeriod
Speed             :    50 km/h

Data for Segment # 3: HARBOUR FT3
---------------------------------
Angle1   Angle2            :  76.00 deg   90.00 deg
Wood depth                 :      0       (No woods.)
No of house rows           :      0
Surface                    :      2       (Reflective ground surface)
Receiver source distance   :  15.00 m
Receiver height            :   1.50 m
Topography                 :      1       (Flat/gentle slope; no barrier)
Reference angle            :   0.00

♀
Results segment # 1: HARBOUR FT1
--------------------------------

Source height = 0.50 m

RT/Custom (0.00 + 59.75 + 0.00) = 59.75 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -28     82   0.00  62.68  -0.79  -2.14   0.00   0.00   0.00  59.75
----------------------------------------------------------------------

Segment Leq : 59.75 dBA

♀
Results segment # 2: HARBOUR FT2
--------------------------------

Source height = 0.50 m

RT/Custom (0.00 + 45.52 + 0.00) = 45.52 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
    58     70   0.00  62.68  -5.40 -11.76   0.00   0.00   0.00  45.52
----------------------------------------------------------------------

Segment Leq : 45.52 dBA

♀
Results segment # 3: HARBOUR FT3
--------------------------------

Source height = 0.50 m
```

```
RT/Custom (0.00 + 51.59 + 0.00) = 51.59 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
    76     90   0.00  62.68   0.00 -11.09   0.00   0.00   0.00  51.59
----------------------------------------------------------------------

Segment Leq : 51.59 dBA

Total Leq All Segments: 60.51 dBA

♀



TOTAL Leq FROM ALL SOURCES:       67.43
♀
♀
```

APPENDIX E

SCHEDULE "F"

Airport / Aéroport **Toronto Island** These contours are subject to change and should be verified with the Corporation at time of use. Les courbes sont susceptibles de modifications et il faut en vérifier l'exactitude auprès de la Société centrale avant de les utiliser. Noise Exposure Forecast / Projection du Bruit Perçu **1990**	Scale 1:50,000 Échelle Miles 1 0 1 2 Milles Metres 1000 0 1000 2000 3000 Mètres Yards 1000 0 1000 2000 3000 Verges Date: April / Avril 1978 Ref. No. / No. de Ref. OR11 Sheet No. / Planche No. 1 Of / De 1	**CMHC/SCHL** N.E.F. contours prepared for Central Mortgage and Housing Corporation by the Ministry of Transport (Canadian Air Transportation Administration) P.B.P. cartes particulières préparées pour la Société centrale d'hypothèques et de logement par le Ministère des Transports (Administration du Transport Aérien du Canada)

APPENDIX F

is being driven by Air Canada's objectives of maximizing its use of Pearson (LBPIA) as its hub airport.

General Aviation

The level of general aviation (GA) traffic at TCCA and other airports in the Toronto region has varied significantly over the last 15 years. Overall, GA traffic at Toronto area airports has declined 23% from 1986, but TCCA's market share has increased from 19% to 27%.

Noise

The Noise Exposure Forecast (NEF) is the accepted method in Canada for determining aircraft noise impact. The NEF system provides for a summation of noise from all aircraft types operating at an airport based on actual or forecast aircraft movements. Exhibit 1 compares the NEF 25 boundary established in the Tripartite Agreement with the NEF levels resulting from the actual traffic in 2000. Noise levels are well within the parameters of the Tripartite Agreement.

Existing 2000 NEF Conditions TCCA

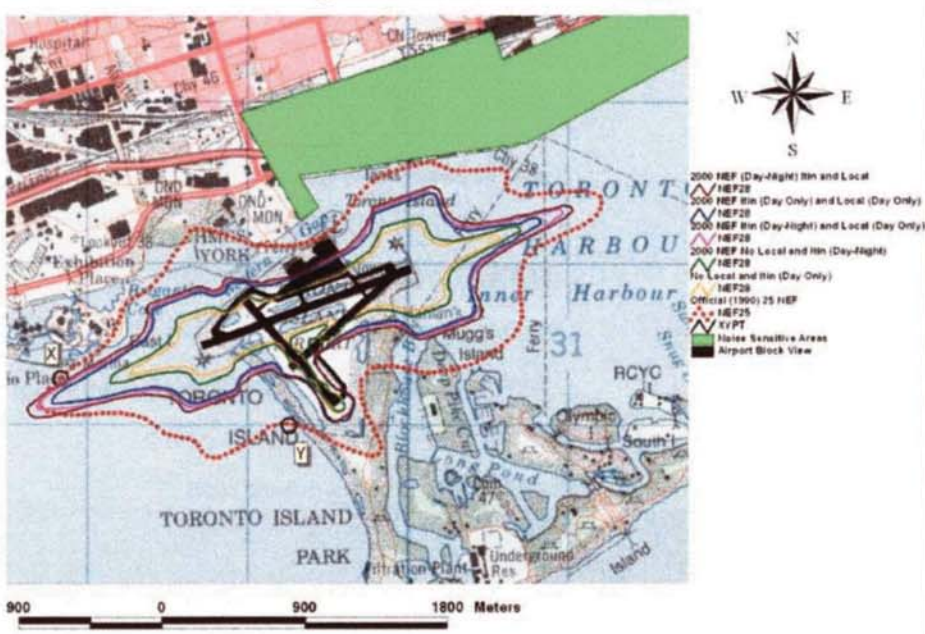
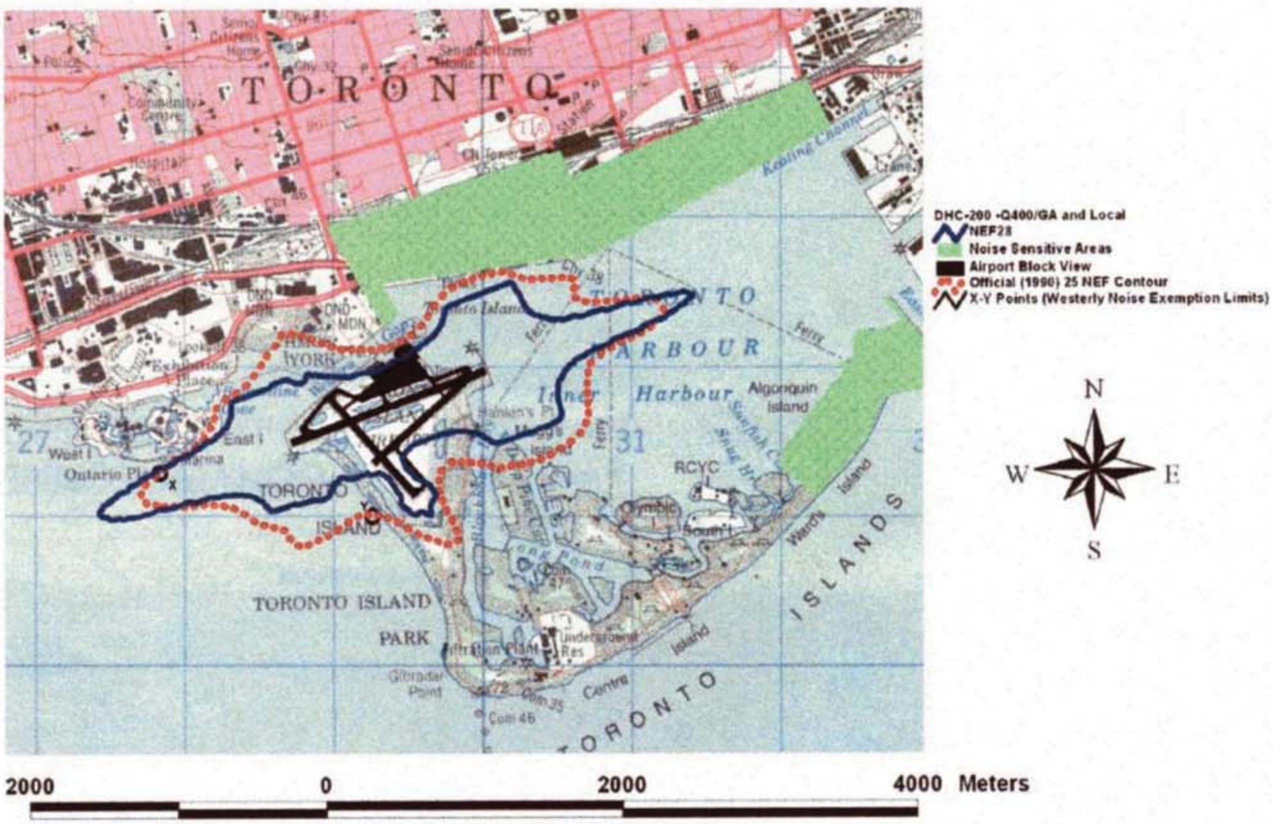


Exhibit 1. Existing 2000 NEF Conditions at TCCA

167 Slots/Actual Q400 Noise Data/GA and Local



General Observations for the above supplemental scenario:

1. This scenario was developed assuming full use of 167 slots
2. GA itinerant and all local (circuit) traffic was included
3. NEF model was updated with actual Q400 noise parameters as supplied by Bombardier
4. The 28 NEF falls within the official 1990 25 NEF but we still see the extension on the east side beyond the permitted limit.

APPENDIX G

Aircraft Movements

Aircraft	2016 Itinerant Movements
DHC8-Q400	168
C172	31
C150, C152	15
Helicopters	13
PC12	5
Piper	5
C206, C208, C210	3
C180, C182, C185	3
Beech	3
Others	10
TOTAL	256